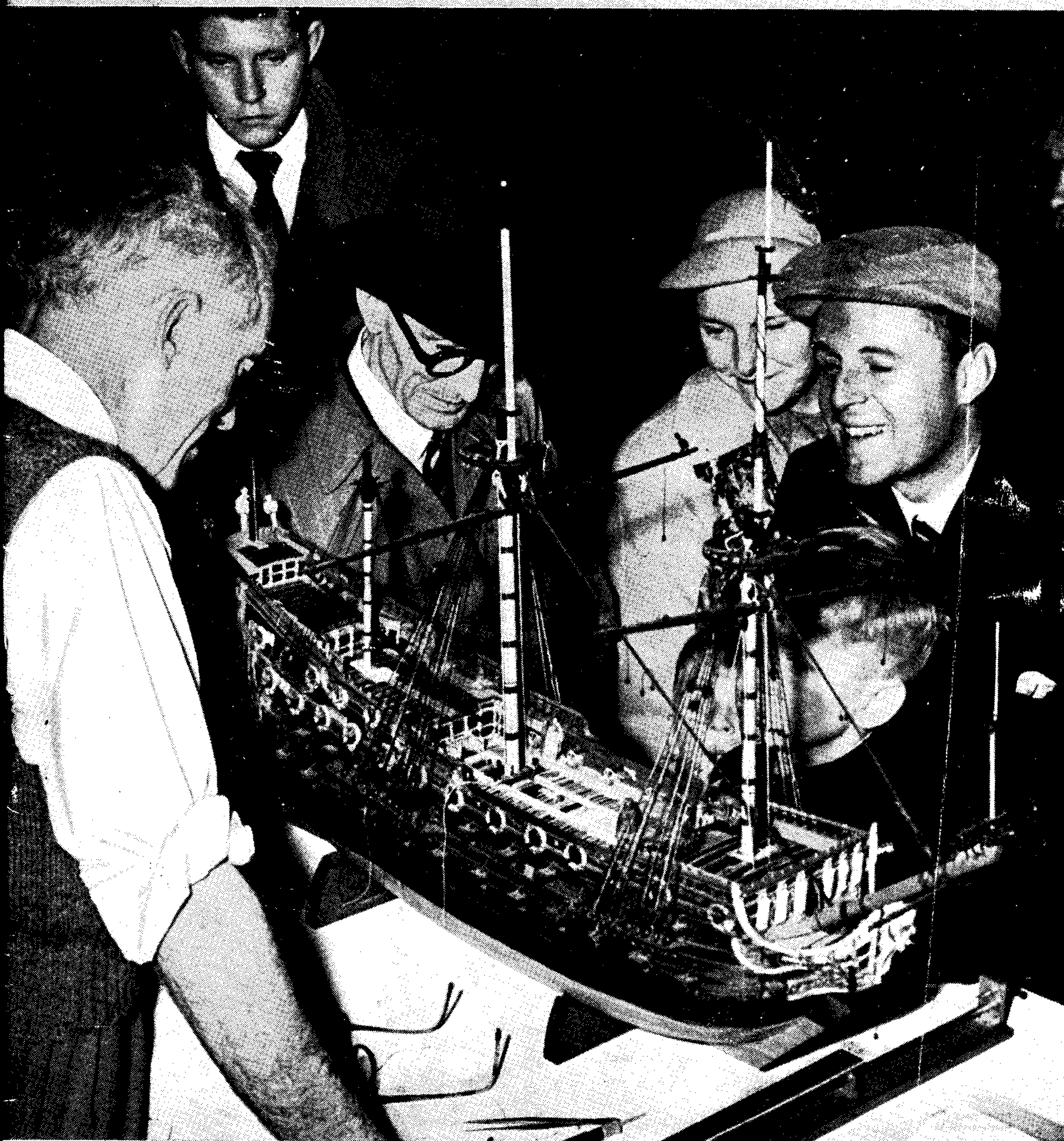
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

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SMOKE RINGS

Our Cover Picture

● THE DEMONSTRATION stand is usually one of the centres of attraction at the "M.E." Exhibition, and this year, Mr. R. J. Collins, of Great Bookham, with his model of H.M.S. *Prince*, was one of its most interesting features. We saw this model in its earlier stages at last year's Exhibition, but it is now well advanced, the hull being practically completed, and the rigging more than half finished. The ships of this period (1670) were more decorative and colourful than at any other period, and Mr. Collins's model shows this very well. The carved and gilded decoration, in conjunction with the dark, rich colour of the planking, much of which was left in its natural colour, makes quite a picture, for which, as will be seen from our photograph, the full, flowing curves of the hull lines form a fitting foundation. Mr. Collins is an enthusiastic lover of the old ships, and his cheery manner on the demonstration stand readily infected his listeners with his own enthusiasm. We are hoping to see his model in our competition section next year.

Another Crush

● MR. R. D. FALLOWFIELD, of Liverpool, writes to say that during the recent exhibition by the Chester Society of Model Locomotive Engineers, the police had to be called to control the crowds waiting for admission, and that so many people were in the Town Hall, at one time, that the fire brigade sent an officer or two, just to keep an eye on things. This is yet another indication of the "pulling power" of the miniature steam locomotive, if in rather a different sense from the one we think of first! We are glad to note, however, that the exhibition was evidently highly successful.

Incidentally, Mr. Fallowfield, enclosed a cutting from *The Liverpool Echo* which refers to a curious little locomotive, known locally as *Owd Ann*, that has been shunting wagons at the Ince Forge, Wigan, since 1896. She is a quaint little object on a 0-4-0 chassis, and appears to have a vertical boiler, the whole lot being enclosed by the cab. Does any reader know anything of her history?

The Wolverhampton Model Engineering Society

● WE ARE very pleased to learn from Mr. J. P. S. Jones that the Wolverhampton M.E.S. is recovering. The publication of our recent note has had the effect, not only of several of the members renewing contact, but also of six new ones joining the society. We trust that, from now on, the society will progress from strength to strength, for we think that there must be a considerable number of our fraternity in Wolverhampton, and we know of no reason why they should be any more apathetic there than anywhere else. We hope that we shall be able to add the society's name to those whose notices appear regularly in our Club Announcements columns. Meanwhile, we extend our best wishes for every success in the future.

Fifty Years "Behind the Scenes"!

● DURING THE "M.E." Exhibition, the members of THE MODEL ENGINEER staff and a few selected friends held a very happy informal party when Mr. Kenneth Garcke, chairman of Messrs. Percival Marshall & Co. Ltd., presented Mr. William H. Evans with a wrist watch to commemorate his record of over 50 years' service in the Editorial department. It was, perhaps, fitting that this event should be held more or less "behind the scenes," as the work done by Mr. Evans during this half-century has been equally unobtrusive; he is known by name to comparatively few readers, yet if any one of the staff were asked who is the most indispensable individual member, there is no doubt that the unanimous answer would be "Bill Evans."

It was very early in the history of THE MODEL ENGINEER—in 1901, to be exact—that young Evans, only just left school, and not yet turned 14, first came to work for the late Mr. Percival Marshall in the capacity of office boy. Since then, his only absences from the office have been due to army service during the 1914-18 war, and for a brief period some years later when surgical attention to old war wounds became necessary. His duties have at various times embraced nearly everything; he has been in turn draughtsman, printers' devil, assistant editor, production manager; indeed, there have been times when he has had to be the complete staff!

Mr. Evans recalled many incidents in the history of the "M.E.," some of which were humorous in retrospect, though at the time they were nothing to laugh at. On one occasion, following the sudden death of the assistant editor, Mr. W. Runciman, he had to work 18 hours a day and sleep in the office. During the last war, despite one major calamity and several minor ones, it was largely due to his foresight and untiring efforts that THE MODEL ENGINEER came out unfailingly on time. The only occasion when publication was suspended was during the post-war fuel crisis, and by Government edict. Barring this solitary exception, the "M.E." can claim, in common with a well-known London theatre, "We Never Closed!"

The Crosby 4-4-0 Locomotive

● ON THE cover of our issue for October 2nd was an illustration of a fine 5-in. gauge 4-4-0 locomotive working at the Crosby Model Club's Exhibition. In our "Smoke Rings" we regretted that we had no particulars of the engine or who built it, but we are pleased to be able to say that we have received a long and interesting letter from its builder, Mr. J. Winstanley, of Maghull.

The building of the engine began in January, 1948, after Mr. Winstanley had seen the outline drawing of the *Maid of Kent*, in the MODEL ENGINEER for December 25th, 1947, which happened to be just what he was looking for at that time. Mr. Winstanley spent seven years of his early life, 1906 to 1913, with the Midland Railway, and he had a strong desire to model one of the Midland locomotives. The model differs from the prototype in several respects, chief of which was the making and fitting of Joy valve-gear, which Mr. Winstanley especially fancied. Working brakes are fitted to the coupled wheels and are applied by hand through a lever attached to the main frame under the footplate, the handle protruding into the cab on the opposite side to the reverse lever, and at about the same height. This fitting has been invaluable and can stop a load of ten passengers quite easily.

The boiler feed arrangements, originally, included a mechanical pump, a Linden injector and a hand-pump on the tender. The injector has been so reliable that the two pumps have been removed; consequently, the coupling-up of engine and tender is merely a matter of seconds, all that is necessary being to offer up the tender to the engine, drop in the coupling pin, push on the rubber connection and—as "L.B.S.C." would say—"Bob's your uncle."

The boiler barrel was rolled from sheet and sif-bronzed down the seam. There was no difficulty in obtaining the heat for this, and all the other brazing, by means of a 5-pint blowlamp. The barrel contains fifteen $\frac{1}{2}$-in. tubes and four $\frac{3}{4}$-in. superheater flues; it is well stayed, tested to 300 lb. and works at 100 lb. pressure.

All machining was done on a $3\frac{1}{2}$-in. Myford lathe, drilling being attended to by a $\frac{1}{2}$-in. sensitive pillar drill. The engine was completed and running in just under twelve months and has pulled many hundreds of people since then, being consistently reliable. On many occasions, she has been in steam for periods of six hours and has finished up as lively as ever.

Mr. Winstanley's second engine, built in eleven months, has a chassis developed from *Hielan' Lassie*, and a boiler and tender from his own drawings. She should be a worthy companion for the 4-4-0.

LOCOMOTIVES

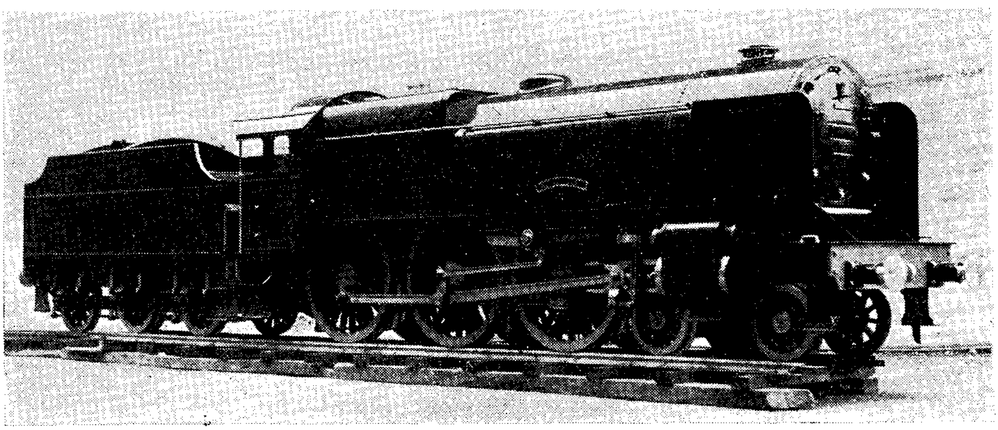
AT "THE MODEL ENGINEER" EXHIBITION

by J. N. Maskelyne, A.I.Loco.E.

THERE were nineteen entries in Class "A" for locomotives, 2½-in. gauge and over, this year, and thirteen of them gained awards. The general standard of excellence was about equal to that reached last year; which is saying quite a lot, since the tendency in this direction seems to have reached its peak in recent years and is being maintained very well. This remark applies, of course, to the winners in this class, as recalled over the past five or six years; during that time, there has been, perhaps, only one locomotive which set a standard that no other has reached since.

interesting job did not score enough to win a diploma, it was judged to be meritorious enough to win the "Reeves" prize, as an encouragement.

No. 4, a 5-in. gauge 0-6-0 pannier tank engine of the G.W.R. "1500" class, by Mr. F. C. Haigh, of Bristol, is another "first attempt" and an astonishingly fine one, too! Mr. Haigh is 70 years of age and, obviously, not lacking in courage. He worked to "L.B.S.C.'s" "words and music" for *Speedy* and then added as much external detail as could be seen in photographs; he did not see any of the prototype engines



Mr. S. A. Battison's 10¼-in. gauge L.M.S.R. "Royal Scot"

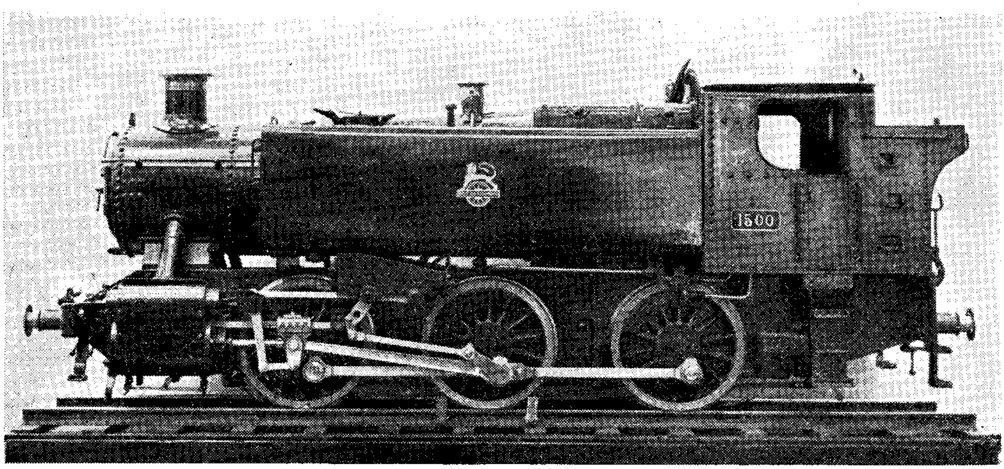
To get down to this year's selection, treating them in catalogue order, the first to notice is the very impressive 10¼-in. gauge L.M.S. *Royal Scot* by Mr. S. A. Battison, of Derby, Cat. No. 1. The workmanship and finish were good, but the omission of the inside cylinder and valve-gear lost it a lot of points under the headings of quantity of work and fidelity. Two surprising errors in the painting further spoilt a fine job; no "Royal Scot" ever had red wheels, and the straw-coloured line on the front boiler band should be on the *inner* edge of the band. However, the final score was exactly 80 per cent. of full marks, which merited a V.H.C. diploma.

No. 2, the next prize-winner, was a very neat 3½-in. gauge *Rainhill* by Mr. J. W. Moon, of Middlesbrough; it is a "first attempt," and the full story behind it may be published in the very near future, as it is certain to encourage other "first timers" to "have a go." While this

until he brought his entry to the New Horticultural Hall, since none of them is stationed in or near Bristol. The result is a very fine job with all the character of the prototype, and it scored exactly 80 per cent. of full marks; the award was a V.H.C. diploma.

No. 6 was the now well-known *Twin Sister Major*, by Mr. J. I. Austen-Walton, a 5-in. gauge L.M.S. 0-6-0 Dock shunter. Frankly, after its author's constant insistence on working to official drawings, even if the job is not intended to be a slavish copy of all the details of the prototype, it is disappointing. Workmanship finish, the amount of work and the suitability of materials are all very satisfactory; but, when it comes to fidelity, even after making every allowance for a *working* model, this job falls down rather badly. Both chimney and dome are too high and too narrow; neither are they their right shapes; the wheels do not seem to be right, particularly with regard to the tyres; the motion

is too massive, making its most important component, the vibrating link (which *is* right) look too slender by comparison ; the rear sandboxes are too far back ; the coupling hooks and links are very poor, and there can be no reason why the front and rear bufferbeams should not be alike, as they are in the prototype. A photograph of the prototype was published on page 82 of THE MODEL ENGINEER for January 20th, 1949, and when compared with the one reproduced here, most if not all of the discrepancies mentioned can be confirmed, especially as both pictures show the same side of the engines from nearly the same angle. Personally, I doubt if any of these engines ever had red-shaded lettering and numerals ; but that is only a small matter without any technical significance. All these faults lost the model a lot of marks ; its score was 84.3 per cent. and its award was a V.H.C. diploma ; it was also awarded the Surrey Hills Live Steamers of Victoria, Australia, prize for fabricated components to replace castings.



Mr. F. C. Haigh's G.W.R. "1500" *class* 0-6-0 *Tank, for 5-in. gauge. An astonishing "first attempt"*

A Museum Piece

This model has now gone to the Science Museum, South Kensington, where it is to be on view for some time. I have not yet seen it there, but I hope that it is exhibited in such a way that the cab fittings can be clearly seen, for they are really beautiful.

No. 7 was a 2½-in. gauge L.M.S. Class "5XP" 4-6-0 locomotive by Mr. D. G. Webster, of Maidenhead. This is a nice little job, very accurate in its proportions and details. The general finish, especially the painting did not rise to the heights achieved by other competitors, but it scored 67 per cent. and won an H.C. diploma.

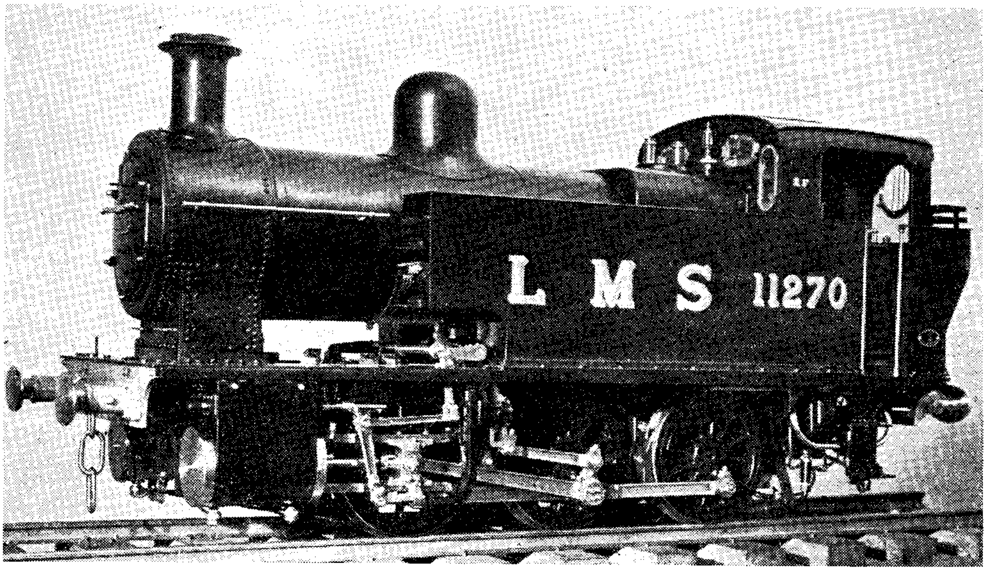
No. 8 was a 3½-in. gauge 4-6-2 *Hielan' Lassie*, by Mr. A. G. Bates of Coventry. This is quite a nice job, but inclined to be a trifle clumsy in details and fitting. The general effect is rather spoiled by a too lavish use of green paint. The cab roof and the interior of the tender should be painted black, to conform to usual locomotive practice. With a score of 64.2 per cent., it won a C. diploma.

The Cup Winner

No. 10 was a very neat 0-6-0 saddle-tank locomotive for 3½-in. gauge by Mr. L. R. Raper, of Wakefield ; it won the Championship Cup and is, without doubt, a little masterpiece. Clearly, Mr. Raper possesses a keen eye for detail and proportion, backed up by mechanical skill and ability. The side-play of the rear ends of the coupling-rods could be much reduced, but otherwise the fitting was most excellent. The cab layout and the proportions and finish of all the backhead fittings are well up to the Austen-Walton standard. And I wonder how many of the vistors noticed the two beautiful little lifting-jacks mounted on the right-hand side of the running board, or were aware of that complete set of marvellously constructed tools in the toolbox, locked by a scale-size padlock, the key for which was hanging up inside the cab ! No wonder the score was as high as 92.7 per cent. ! After the judging was over, I returned several times to this model ; the more I looked at her the more I admired her. She is not quite like any locomotive known to me, but a prototype built to the same design would be a real joy in all respects.

No. 11 was a 5-in. gauge "Halton" 4-6-4 tank engine, of sturdy and robust construction and splendid finish, by Messrs. G. and P. Wheeler of West London. It is one of the best "Haltons" I have seen, and its score of 87 per cent. won it a well-merited Silver medal.

No. 15 was a 3½-in. gauge L.M.S. Class "5" 4-6-0 engine built by Mr. S. Marlow, of Richmond, out of odd pieces of metal obtained from various sources. The basis was the ever-popular *Doris* by "L.B.S.C." but what added a lot of interest and not a little prestige to Mr. Marlow's example is the fact that, before he could build the engine, he made a lathe to enable him to get started !

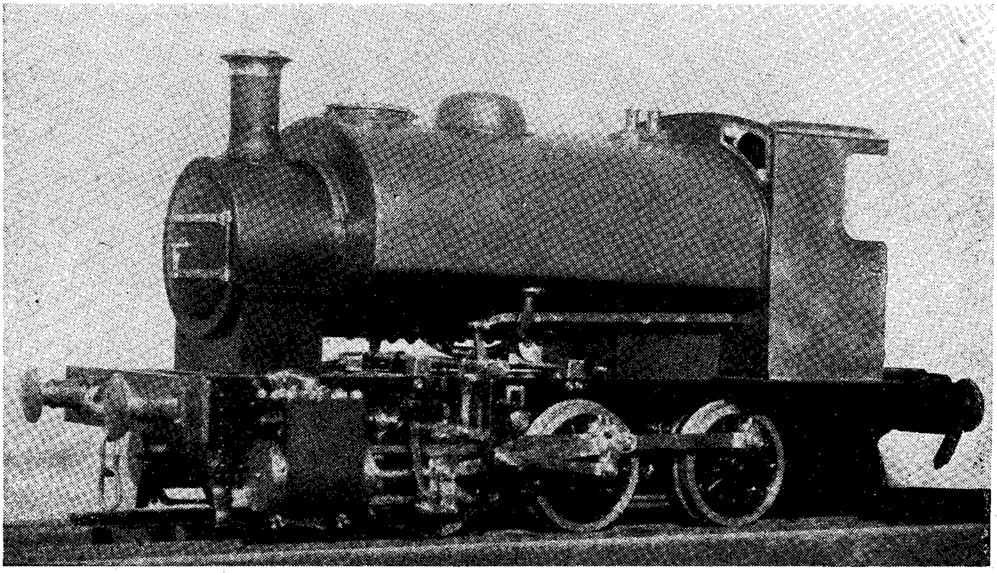


Mr. J. I. Austen-Walton's "Twin Sister" Major

The result is a worthy little job, especially as it is a "first effort at model engines"—to quote Mr. Marlow's description of it. It won a C. diploma, with 64.2 per cent. score, in spite of those big brass boiler bands!

No. 16 was a most interesting exhibit, a $3\frac{1}{2}$-in. gauge "Crewe Goods" engine of the old London and North Western Railway. It is left unpainted and is very attractive, but it will not bear very close inspection. It is somewhat clumsy in most of its details, and its coupled wheels are far from filling their splashers. There is a lot of work in it, however, and I must say that I wish many other enthusiasts would try their hands at something similar. Mr. Harris scored 65.7 per cent. which merited a C. diploma.

No. 17 was a $3\frac{1}{2}$-in. gauge L.M.S. 0-6-0 tank



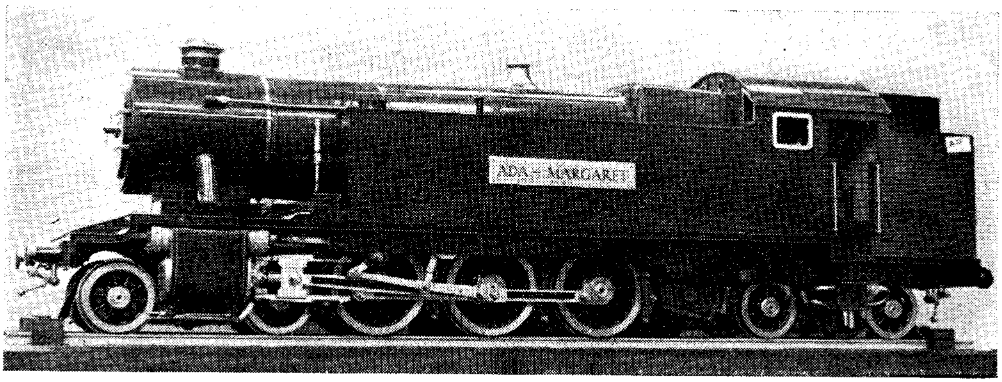
The Cup-winning 0-6-0 tank engine, for $3\frac{1}{2}$-in. gauge, photographed in an unfinished state during steam trials

engine, built to the *Molly* particulars, by Mr. C. J. Hainge of Oxford. It is a very good one in every way and gained high marks under all heads; its total score was 85.5 per cent., which not only put it in the Bronze Medal class but also won it the Bradbrooke prize. I would like to see a more shapely chimney on it, though.

making a cup available to the traction engines. At present, there isn't one.

The Loan Models

There were two exhibits in this section that I would like to mention; one was a set of parts, assembled so far as they can be at present,



The 5-in. gauge " Halton " tank by Messrs. G. & P. Wheeler

for a $\frac{3}{4}$-in. scale Dean locomotive bogie. This exhibit, which is to be used eventually on a model of a Great Western Railway Dean 4-2-2 express locomotive, is the work of Mr. D. G. Webster, of Maidenhead, and is of particular interest to me, because it is the first time that I have seen one of these decidedly unusual bogies modelled exactly to scale. That is not to say there has never been such a thing, but I have not seen one before. Mr. Webster is certainly making a fine job of it, and is using fabricated components instead of castings wherever he can do so. The result is neat and very clean, but it must have required much forethought and not a little planning to ensure that it can be put together properly and taken to pieces, if necessary, afterwards.

The other Loan exhibit I want to mention was a $3\frac{1}{2}$-in. gauge Great Western Railway " Saint " class 4-6-0 locomotive which its builder, Mr. F. P. Arnold, of Slough, modestly describes as " semi-scale." This fine job is not quite finished, so I will not make much comment about it at this stage; but it is " Swindon " from end to end and from top to bottom, and regarding it as a faithful little " portrait " of its prototype, I know of nothing to beat it. In short, it is exactly what a good working model of a prototype should be.

There is just one other point I want to mention; it is that no locomotive known to me, or anybody else, ever had its footplating lined out! There were two examples in the show, and I, for one, would be most interested to know why. In neither case had the lining been well done, and it struck me as being merely a waste of time and effort, adding nothing necessary or useful to the models.

No. 18 was a 5-in. gauge 0-6-0 engine to the *Minx* design by L.B.S.C., and built by Mr. F. Granger of Hitchin. It is a nice job, well built, and well finished; but the lining-out could be much better done with a pen. Its score was 68.5 per cent. and its award an H.C. diploma.

No. 19 was another *Doris*, this one being the work of Mr. F. Joslin, of Kenton. Its chief merit was the amount of work that had been put into it, though it was a good average specimen of its type. It won a C diploma, having scored 64.2 per cent.

Good Also-rans

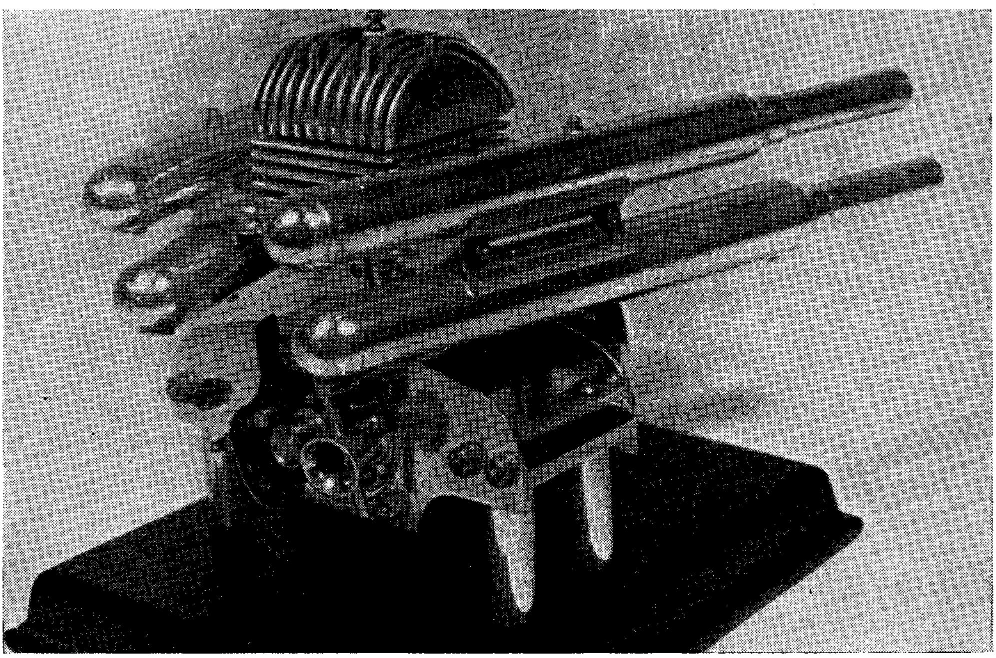
The above were all in the prize-winning category; some of the runners-up were very close behind, and if the judges had not fixed the limit at " above 60 per cent.", seventeen out of the nineteen entries would have won *something*. It is necessary, however, to maintain a high standard for the awards at the " M.E." Exhibition; otherwise they would become too cheap! I would stress the point that full marks under one heading, or even two headings, would probably never gain an award; the target to aim at is full marks under all headings.

Before I close these notes, I would add, as a matter of interest, that the eleven traction engine entries in Class " L," taken as a whole, showed better work than the railway locomotives. In fact, the three top scorers in Class " L " each scored more than the Cup-winner in Class " A," their scores being, respectively, 97.4, 93.7 and 92.8 per cent. It is a long time since anything like this happened, and if it goes on we shall have to give serious consideration to

Internal Combustion Engines

by Edgar T. Westbury

THE 15 c.c. engine by Mr. G. J. Chapman, of King's Lynn, was chiefly notable for its imposing array of no less than four silencers, and for the glittering finish on these appendages, no less than that on most of the other engine parts. With the particular port arrangement of the engine (which appeared to follow similar lines of design to some of the successful modern speed boat engines, including a rotary admission valve), two silencers would be normal, but it is not quite clear what useful purpose is served by doubling the number. This engine had undoubtedly been the result of some painstaking work, and had this diligence not been also extended to the " spit and polish " finish, some of the good workmanship might have been more apparent. Some day, perhaps, exhibitors will learn that a highly buffed-up finish is always open to suspicion—it can be used to hide either good or bad work equally effectively—apart from which, a brightly polished cylinder and head on an air-cooled petrol engine is functionally wrong, as it defeats the object of the most elaborate attempts to radiate heat from the cooling fins. A little elementary " applied science " will teach the designer that these should at least have a dull matt, if not a dead black, finish.



A 15 c.c. high-efficiency two-stroke engine by Mr. G. J. Chapman

Marine Section

A number of interesting engines made their appearance in model power boats, including the very workmanlike twin engine in Mr. G. A. Nurthen's radio-controlled cabin cruiser, the engine-room of which was very well laid out generally, and quite a contrast to that of many experimental craft, radio-controlled or otherwise, which have been seen in the past. Another interesting engine-room was that of Wing-Commander J. F. Lewis's Bristol air-sea rescue launch, which was fitted with a 15 c.c. " Seal " four-cylinder engine, but the transmission gearing in this case was not so well laid out, and appeared to be the weak link in an otherwise efficient installation.

The 30 c.c. engine of the hydroplane by Mr. K. W. Chappell was of very striking appearance, and embodied good workmanship, the finish in this case not being overdone. It was fitted with a nicely made float-feed carburettor,

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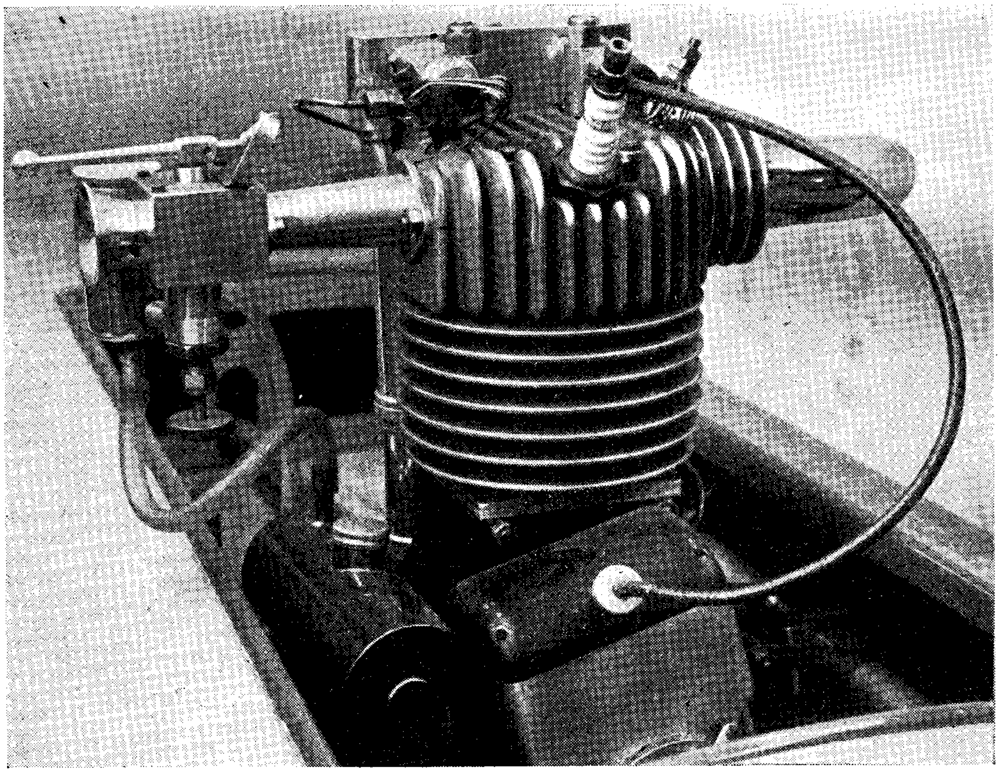
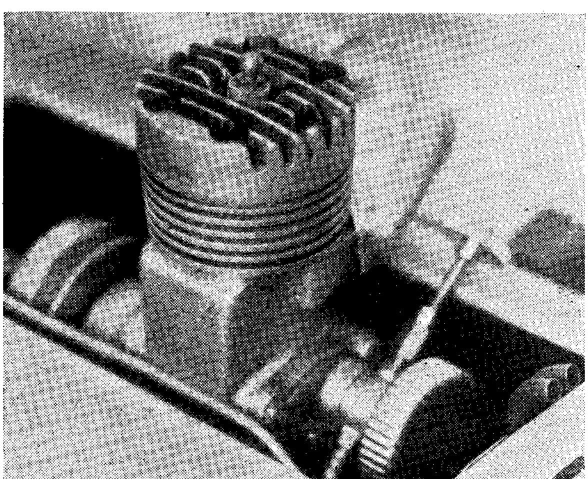
Continued from page 634, " *M.E.*," *November* 13, 1952.



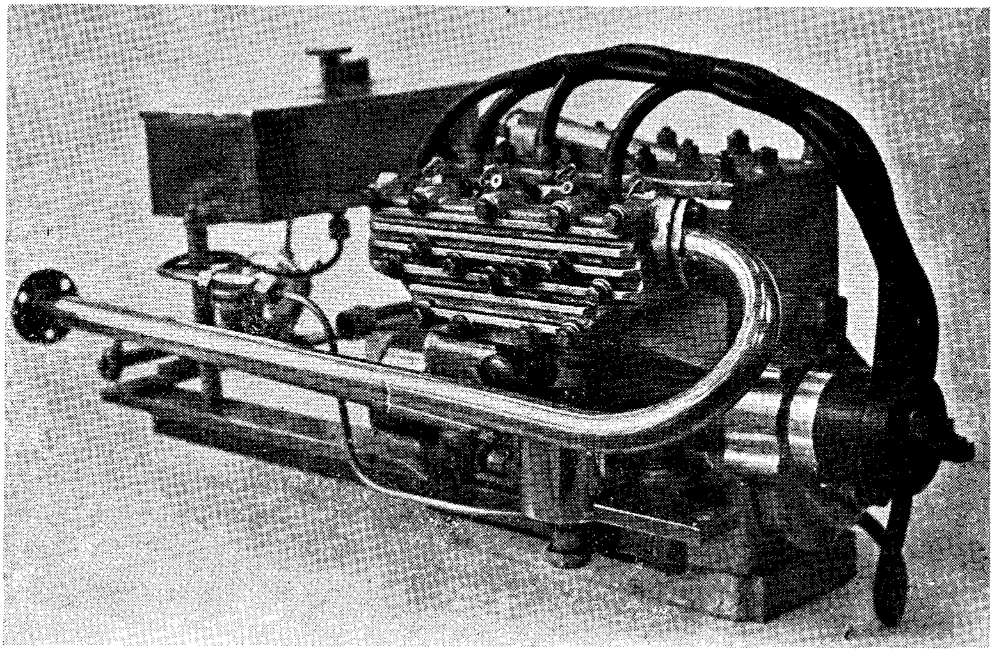
The 30 c.c. engine of Mr. K. W. Chappell's hydroplane

apparently having a barrel throttle, and a totally enclosed high-tension magneto, which, so far as could be judged by external appearance, seemed to be highly practical. The valves were operated, through enclosed rockers and push-rods, from two separate camshafts, but a discordant note in an otherwise harmonious design was struck by the tiny hairpin valve springs, which did not seem adequate for controlling the valves at anything like the speeds for which the engine would appear to be designed, or indeed would be necessary for driving the hydroplane effectively.



The 10 c.c. engine of Mr. R. A. Phillips's record-breaking hydroplane "Foz II"

From the point of view of appearance, quite a contrast was presented by the engine of the adjacent boat, *Foz*, by Mr. R. A. Phillips, which is a "C" class record-breaker with a speed of over 69 m.p.h. to its credit. But despite the apparent simplicity of the two-stroke engine in this boat, the discerning eye could detect not only the careful detail work, but also the evidence of experimental work over two seasons of trials and competitions. In calling attention to this comparison, however, it is not my intention to decry the more elaborate forms of designs, or to deter constructors from following the most advanced lines in either four-stroke or two-stroke engine developments; I simply remind them that there are several ways of "killing a cat," and nobody yet is in a position to say which is the most effective.



The power unit of Mr. J. B. Skingley's launch "Josephine"

The display of boats on the M.P.B.A. stand, most of which have had a very active life, and in more than one case bore the scars of battle, contained several interesting engines, including the large single-cylinder two-stroke of the cabin cruiser *Moiety*, and the horizontal four-stroke of Mr. Vanner's new launch, which follows the *Leda III* traditions in arrangement, but has *both* valves mechanically operated for a change. Designs familiar to "M.E." readers were represented on this stand by an Apex Minor 15 c.c. engine, by a member of the Croydon club, Mr. L. Cassanet's "1831" twin, shown partly dismantled, and the "Seal Major" 30 c.c. four-cylinder unit of Mr. J. B. Skingley's launch *Josephine.*

The set of steel dies for gravity casting pistons, entered in the tool section by Mr. J. W. Sullivan, of London, S.W.8, deserves mention here, if only as an object lesson. It is a typical example of one of the many byways which have to be explored by high-efficiency engine constructors. The advantages of die-castings, not only for pistons, but also other structural parts of petrol engines, are too well known to need detailed explanation, and many constructors, including Mr. R. A. Phillips, mentioned above, have had to undertake a considerable amount of experimental work in producing suitable dies for making sound, close-grained castings in high-grade light alloy. In the exhibit in question, proof of the success of the dies is afforded by the sample pistons, including one in section, to show that the metal is uniform in section and homogenous in structure.

Trade Section

The most prolific display of internal combustion engines at this year's Exhibition was that on the stand of Electronic Developments (Surrey) Ltd., which featured several sizes and types of compression-ignition engines, together with a range of accessories, such as marine propellers and transmission gear. Evidence of the reliability and consistent running of these engines, over long periods and under full load, was afforded by the exhibit of the radio-controlled boat, *Miss Eedee*,

A set of piston dies, with specimen castings, by Mr. J. W. Sullivan

the first model boat in history to cross the English Channel.

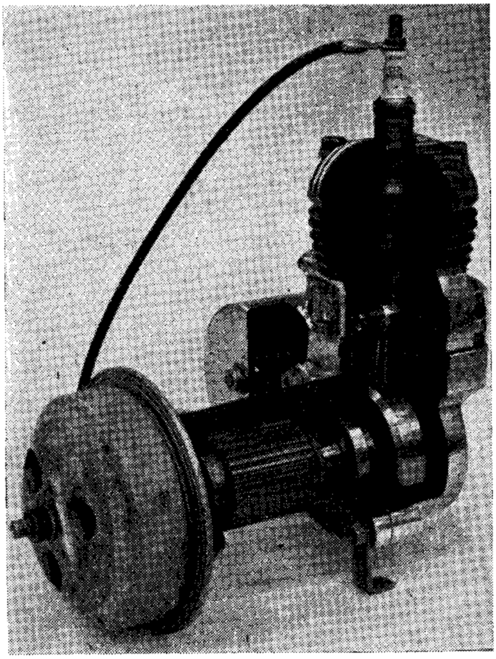
Startling Design

An entirely new and rather startling development in i.c. engine design appeared this year on the stand of the Myford Engineering Co. Ltd., namely, the Myford twin cycle engine. At the time of writing, a full specification of this engine is not available, but it may be said that it is of advanced design, having inverted cylinders arranged pannier-wise over the rear wheel, and surmounted by a neat saddle tank, the drive being by friction roller on the cycle tyre. The engine was shown partly sectioned, and rotating slowly, being driven through the cycle wheel by a concealed motor. It was shown primarily to demonstrate what can be done in the way of advanced engine construction with the aid of a Myford M.L.7 lathe, but it is probable that castings and parts will be available to constructors in due course.

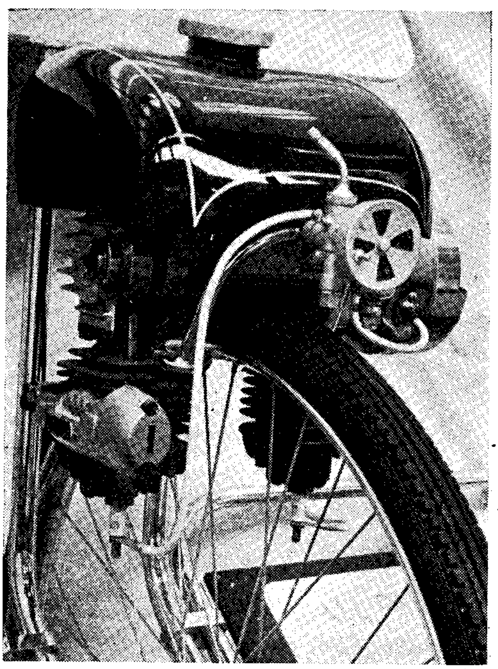
A number of compression-ignition and glow-plug motors of various makes were to be seen on several stands, mostly in connection with displays of model aircraft accessories. In addition, Precision Model Engineering Co., of Liverpool, showed the 10 c.c. "C.I. Special" o.h.v. four-stroke engine manufactured and formerly marketed by Messrs. J. & G. Jensen, of Jersey.

Improvements

The "Busy Bee" 50 c.c. auxiliary engine was again featured by Messrs. Braid Bros., of Hackbridge, whose display included a finished engine, and also one in part section. Several detail improvements have been added to the castings and parts, including light alloy cylinders with cast-in high tensile steel liners, which call for the minimum machining work. Castings are now available for the special "Busy Bee" carburettor and control lever, and further developments are in progress. At the Exhibition, several constructors of this engine came forward with verbal testimonials to its success, not only as a cycle power unit, but also in performing other useful duties.



A part-sectioned "Busy Bee" 50 c.c. engine, by Braid Bros.



The new Myford twin cycle engine

Lack of Supplies

Apart from this example, however, one looked in vain for any assistance from the trade in respect of castings and parts for constructing i.c. engines of any kind. This is, in my opinion, much to be deplored, and it is not entirely to be accounted for by lack of interest among prospective constructors, to judge by the many queries I receive on this subject. In pre-war days, there were several firms who supplied castings for petrol engines of various types, but most model supply firms nowadays can only offer ready-made diesel or glow-plug engines, covering only the smaller sizes up to 5 c.c. I have often been accused of bias against the commercially-produced engine, but I have, on the contrary, given a good deal of help to the manufacturers of such engines, and I think it is not too much to ask that they should do something to assist those who prefer to build engines for themselves.

Building a Slotting Attachment
for the Myford M.L.7 Lathe
by "Duplex"

THE slide bracket (*H*) illustrated in Fig. 8 is also of built-up construction. Whilst every care should be taken in making the various parts comprising the bracket, it should be remembered that the face of the T-slotted component may be machined truly at right-angles to the abutment face of the triangular plate after the bracket has been put together. To do this, the component is secured to an angle-plate fixed to the faceplate by means of bolts passing through the two large holes seen in the dimensioned

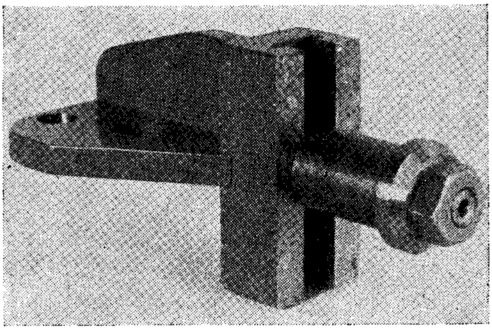


Fig. 8. The slide bracket "H," with little-end bolt in position

drawing (Fig. 9). It will be observed that the triangular plate is let into the T-slot piece. This arrangement is used so that the thrust of the connecting-rod may be transferred directly to the plate, and thus relieve the fixing screws from any imposed load.

The vertical rib serves to hold the two aforementioned parts at right-angles to each other and should, therefore, be made as carefully as possible to ensure that its abutment faces are perfectly flat and square with one another. The method used for machining the side plates of the bed bracket (*B*) are equally applicable in this instance.

The T-slotted head for the slide bracket is made from a piece of rectangular mild-steel that is first machined to the correct width and depth when mounted in the four-jaw independent chuck. When this work has been carried out satisfactorily, the component is mounted on the lathe top-slide so that, after the part has been set truly square with the axis of the lathe and at centre height, the T-slot can be formed. In order to do this a $\frac{5}{16}$ in. diameter end-mill is first used to cut a slot $\frac{5}{16}$ in. deep. After this operation has been carried out, a $\frac{1}{2}$ in. T-slot cutter is employed to mill out the surplus metal at the base of the slot. The $\frac{1}{4}$ in. wide slot for the triangular plate can now be milled at the back of the component, which, for the purpose, is turned on the top-slide so that its long axis lies parallel with the centre-line of the lathe. The work must project over the edge of the top-slide so that the milling saw may be fed into the full depth of the slot without fouling the edge of the slide. The width of the slot must be made so that the triangular plate is a light drive fit when the two parts are assembled.

No remarks are necessary in connection with the holes for the fixing-screw holes except to call attention to the screw that holds the T-slotted head to the triangular plate. This screw is countersunk, since there is not room for the cheese-head variety.

The small-end bolt (*G*) illustrated in Fig. 10 is of similar construction to the crankpin and calls for no special comment except to repeat the advice about the cast-iron bush already given, namely, make sure that both ends of this part are square with the bore.

The connecting-rod (*F*) has been left till the last because the methods used for making this part

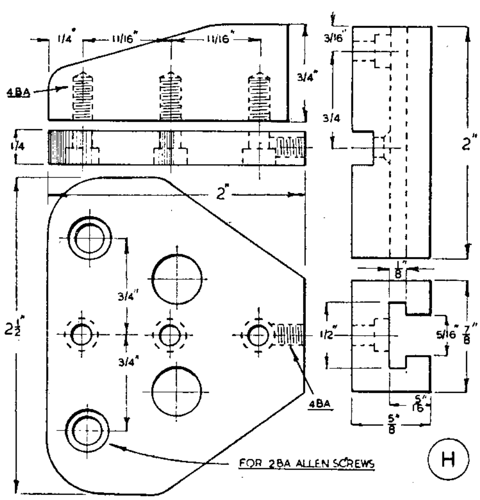


Fig. 9. Details of the slide bracket

may be applied whenever a simple connecting-rod is needed, thus the matter is one of general interest.

The part has already been illustrated in Fig. 7 where it is seen with the driver plate. The details of the connecting-rod are given in the illustration (Fig. 10) and the series of operations for making the component are depicted in Fig. 11.

Reference to this illustration will show that the

Continued from page 647, "M.E.," November 13, 1952.

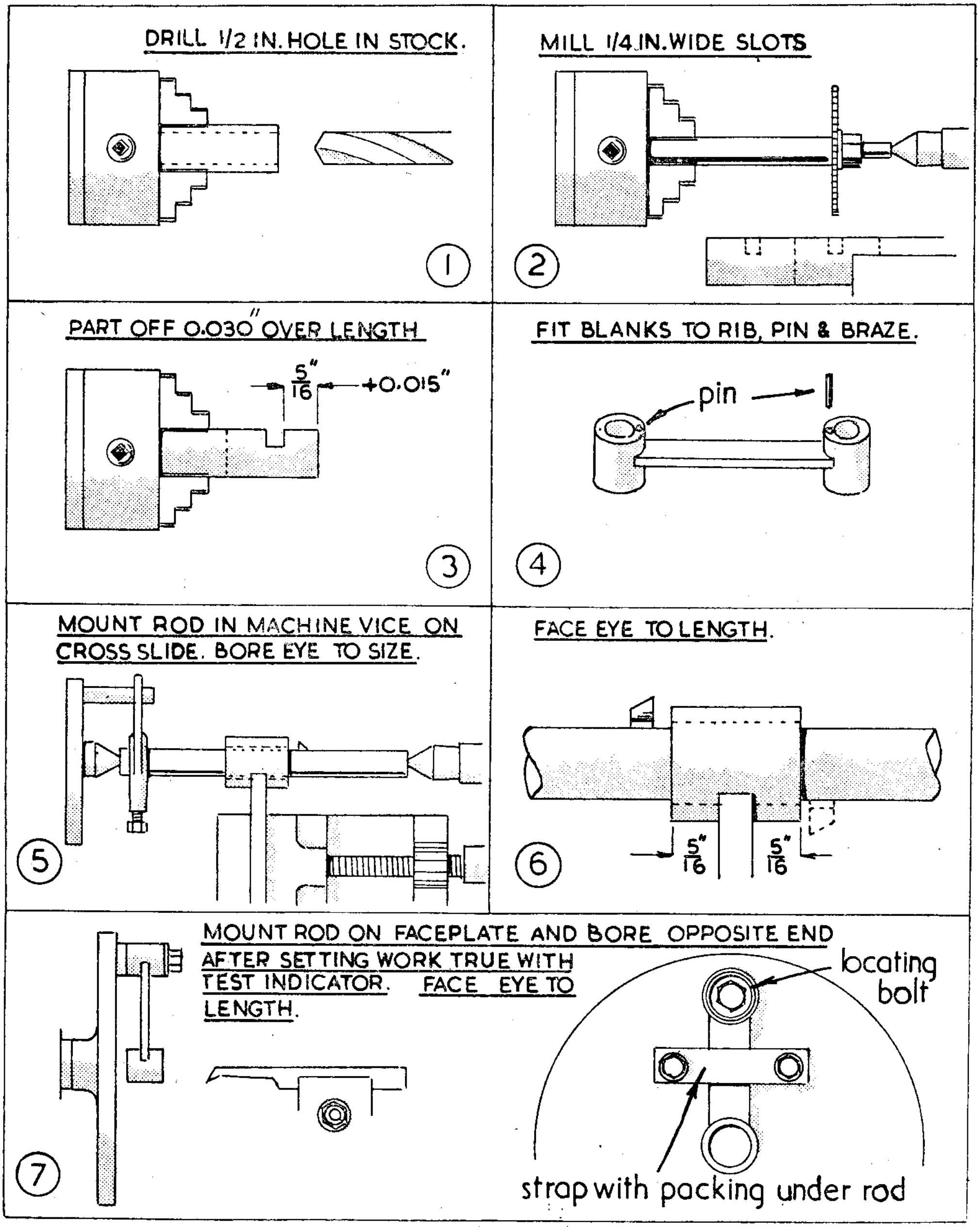


Fig. 11. Sequence of operations for machining the connecting-rod

first operation is to drill a $\frac{1}{2}$ in. diameter axial hole in a length of $\frac{7}{8}$ in. diameter mild-steel rod so as to form a core hole. This hole reduces the amount of material that has to be heated up during the subsequent brazing operation.

After the blanks have been parted off from the bar material, the body of the connecting-rod can be made from the piece of flat mild-steel that has been tested and found to be a firm fit in the slots previously milled in the blanks. The blanks and the body are then assembled by pressing them together; this part of the work can very well be carried out in a vice, provided that packings are used to protect the work. After assembling the parts, a hole is drilled, as illustrated in Fig. 11, Operation 4, to take a close-fitting pin. This will

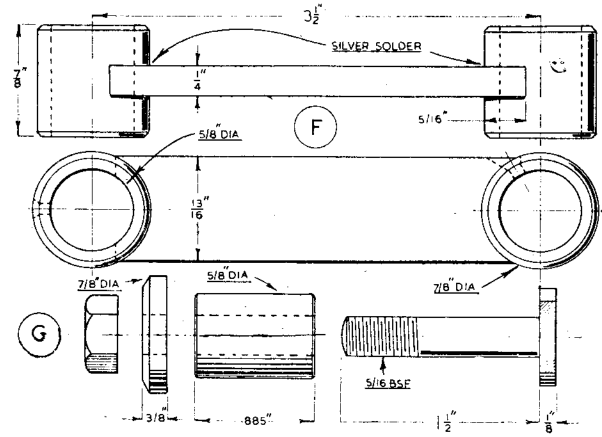


Fig. 10. *Details of the connecting-rod and small-end bolt*

keep the parts from shifting during brazing. The connecting-rod may now be silver-soldered, then dipped in pickle and cleaned up.

When the brazing has been completed, the connecting-rod is set up in a machine vice secured to the lathe cross-slide so that one eye of the rod can be bored to size by means of a boring bar running between centres, as depicted diagrammatically in Fig. 11, Operation 5.

Following this operation, and at the same setting, the connecting-rod eye is faced to length, as seen in the sketch, Fig. 11, Operation 6. As will be observed, a flat-faced tool is made to sweep the end of the eye, thus machining it to the correct length of $\frac{5}{16}$ in. as measured from the face of the rib.

The work must now be removed from the machine vice and transferred to the lathe faceplate so that the eye at the opposite end of the rod may be machined.

The component is, therefore, set up on the faceplate, as depicted diagrammatically in Fig. 11, Operation 7, and as seen also in the illustration (Fig. 12) where it will be observed that a locating-bolt is passed through the machined eye of the connecting-rod. This bolt will secure the rod at the correct radius, but, of course, cannot be relied upon to hold the work firmly against the stresses imposed by the actual machining operations. For this reason, a strap is fastened over the body to hold the connecting-rod firmly against packing placed under the body. In order to ensure that this packing does not throw the work out of alignment, a dial test indicator should be applied to the face of the eye ; any movement of the work, as the packing is put in place or the strap is tightened, will then be recorded.

If only one connecting-rod is being made, an ordinary bolt passed through the eye of the rod will suffice. However, when two or more similar rods are made, and it is important that their measurements should be identical, the simple locating-stud depicted in Fig. 13 should be used.

The stud is firmly secured to the faceplate at the correct distance from the centre ; the alignment of the first connecting-rod will give the position required. Thereafter, the remaining rods are placed on the stud and secured by the nut and washer seen in the illustration.

The stud must, of course, fit the eyes of the connecting-rods firmly, or the rods will not be accurately located. Some workers use, in addition, a pair of clogs provided with adjustment-screws that make contact with the sides of the eyes. Once they have been adjusted, these fitments enable the work to be put into place and secured by the clamping strap without further checking with the test indicator.

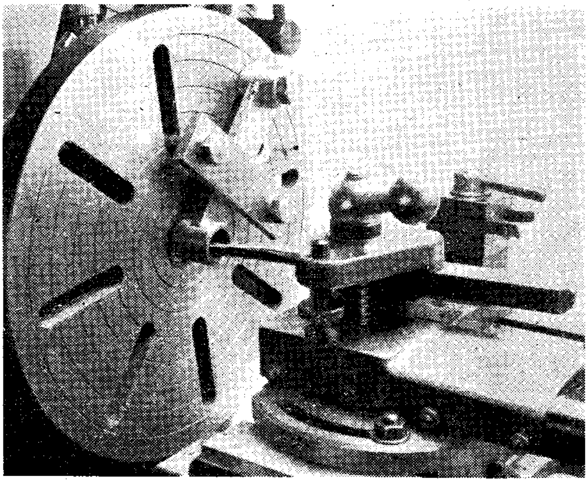


Fig. 12. *Machining the connecting-rod of the slotting attachment. For the sake of clarity, the balance weight has been removed from the faceplate*

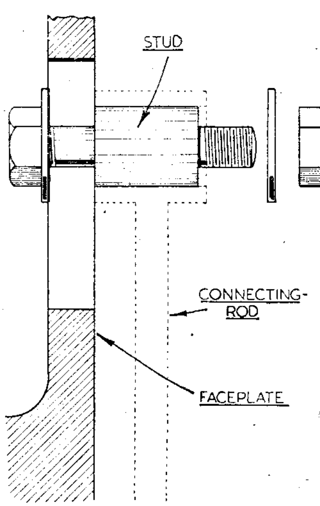


Fig. 13. *A simple locating stud for use when machining a number of similar connecting-rods*

SMALL ELECTRIC GENERATORS

Hints for Fitting-up and Wiring

by J. W. Cooper

HAVING recently received several enquiries as to layouts for small generating plants using surplus apparatus, I think a few remarks on this matter may be of interest to readers of THE MODEL ENGINEER.

Quite a number of generators now available on the surplus market are suitable for use as battery chargers. There are several types available, some generating a.c. current, the others furnishing d.c. It should be noted that direct current is necessary for battery charging; with the a.c. generator, a d.c. supply can, of course, be made available by the use of a suitable rectifier. This article is intended for the operation of the d.c. machine only.

The generators may be either shunt or compound wound. The advantage in the choice of either machine will depend upon the operating load in mind; if just simple battery charging is to be carried out, then the plain shunt generator is suitable. If on the other hand, a fluctuating load is likely, the compound machine should be chosen. On a fluctuating load the shunt wound machine is not so capable to deal with sudden changes of load with good regulation. In an installation, and where intermittent power loads are used together with lighting, the compound generator should be chosen because this machine will handle sudden demands with good regulation.

So far as steady voltage regulation is concerned, it must be stressed that the driving member must be capable of close regulation so far as speed is concerned; this calls for fine governing at the source of driving power used. Where an engine having only one cylinder is used, an extra heavy fly-wheel should be provided to assist steady running.

Hand Regulation

Apart from close governing at the power source, some hand regulation is also necessary on the generator itself. This is accomplished by providing a regulator connected in the shunt field coil of the machine, this regulator is known as a shunt regulator, and it is a simple variable resistance either of the radial or sliding type. The value of the resistance required will depend upon the field current of the generator; if this value is known, the required resistance can be worked out by Ohms law. Where the value is unknown, an ammeter should be connected in series with the field coil and the reading noted when the generator is giving full volts. Shunt regulators must not have an OFF position; a field coil circuit should not be broken while it is carrying current, the reason for this is because the winding is of a highly inductive nature, and it is possible for the winding to be damaged by the induced voltage set up at the instant of breaking the circuit. In circumstances where it becomes necessary to break a generator shunt circuit, for example, where this coil is excited from a separate source, special precautions are taken to prevent damage by providing a special style of switch for this circuit, which is known as a field discharge switch. When this switch is opened, a suitable resistance is connected in parallel with the field coil just before the switch finally opens; this resistance takes charge of the induced voltage by providing a path for it. This induced voltage referred to is caused by the sudden collapse of field magnetism. At the instant of switching off this supply, the sudden loss of this magnetic force induces another current in the coil and in the opposite direction; extremely high voltages arise under these conditions.

Voltage with Safety

When selecting generators for battery charging, it is necessary to see that they are suitable for this purpose and that they are capable of providing the necessary voltage with safety. A single battery cell requires a voltage of approximately 2.5 to enable it to be charged; a 12-volt accumulator, therefore, will need a voltage in the region of 30. Bearing this in mind, it will be seen that a generator marked 12 V, may not meet these requirements for increased voltage without doing damage to its windings. With all generators, an increase in voltage is attained by increasing the driving speed. Any car generator, of course, is designed for its special duty regardless of the fact that it is marked as 12 V. This fact, however, may not apply to other types of machines offered for sale on the surplus market, and this is a point that should be carefully noted at the time of purchase.

In addition to the shunt regulator referred to, a series regulator is also necessary; this regulator is fitted in the charging circuit, its purpose is to regulate the current being fed to the battery being charged, and it becomes necessary to be able to adjust the charging current to suit different battery capacities. Also it is advisable to have some means of regulating the current to a single battery as the charge proceeds. With this series regulator, it does not matter whether it has an OFF position or not. In some cases it is usual to incorporate an automatic cut-in and cut-out in the charging circuit; the use of a cut-out prevents the battery circuit being closed before the correct charging voltage is reached. It also prevents the generator remaining connected to the battery should the driving member fail to maintain its speed or stops. Briefly, this automatic cut-out is not unlike an electric bell movement, but having only one bobbin; the armature which is movable, carries contacts large enough

to carry the current required, this also applied to the fixed contact. On the bobbin of the iron core, there are two windings, one of fine wire, usually wound on first ; over this is a wire of a section that will carry the charging current. The two windings are known respectively as shunt and series, the shunt winding being connected across the generator, and the series winding is in series with the battery being charged. Fig. 1 shows the set-up using this device. The

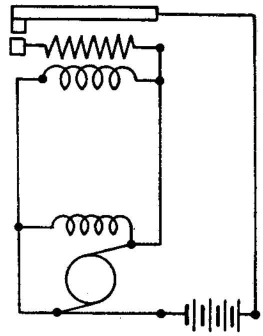


Fig. 1. Circuit arrangement of single cut-out

operation of the cut-out is as follows :—when the voltage of the generator rises to a value higher than that of the battery, the shunt coil will attract the armature and close the charging circuit ; the magnetic pull of the shunt effort, however, would not be strong enough to close the cut-out contacts sufficiently firmly to carry the heavy charging current. The series coil of the cut-out is arranged to be in the charging circuit and connected so as to assist the shunt coil, which it does ; and so creates the necessary pull required. During normal charging, the cut-out remains closed : should for some reason, the generator volts fall below that of the battery, the cut-out will open and so disconnect the battery from the charging source. What actually takes place is this ; at the instant that the generator volts reach a value that is lower than that of the battery, current from the battery will now try to flow to the generator ; this flow takes place *via* the series coil of the cut-out. Under these conditions the current is now flowing in a reverse direction, this means that the magnetic field of this coil is also reversed ; as the shunt coil is still being fed by the generator, magnetism is maintained here in the same direction as for charging, the reversal of the series coil cancels out the effort of the shunt coil and the cut-out opens.

Cut-outs

There are a range of cut-outs in use, each having their own special feature, their ultimate aim, however, is the protection of the battery being charged. In a car, the plant is self-contained and is entirely automatic in every way.

Where battery charging is concerned, it should be stressed that groups of batteries are always charged in series, never in parallel. Separate batteries will not all be at an equal level so far as capacity is concerned. Battery groups should be arranged as separate circuits, each having its own regulator ; also, the batteries should be grouped so that they are all of the same amp. hour capacity ; the matter of A.H. capacity is not quite so strict because if the charging current is the same for all cells in the group, it is then only a matter of removing those that become charged first. All charging should be carried out remote from the generator ; battery fumes are harmful to any insulation. Charging for the first time should always be in strict accordance with the respective makers instructions. In subsequent charging, it should be observed that the acid gravity is correct and that individual cells come up to an equal voltage ; the fact that cells may be gassing freely is no indictaion of their state of charge. Any cell not up to standard at the end of a charge should be treated separately until it is normal. Causes of faulty cells are many ; wrong acid gravity at the start, leaky cells (this means

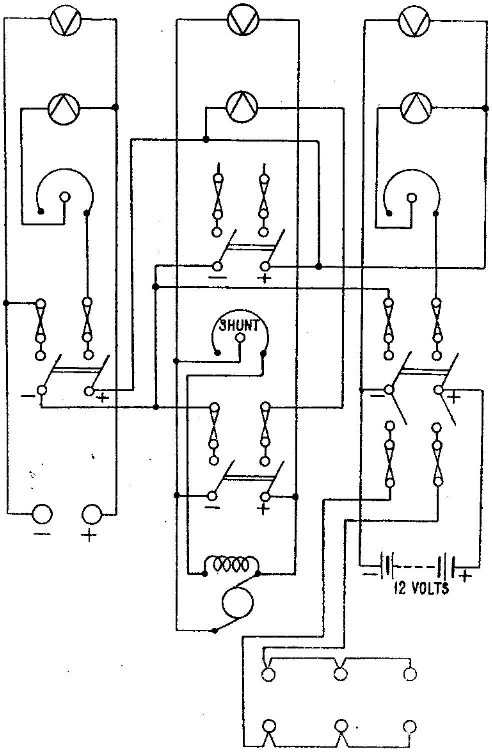


Fig. 2. Arrangement of switchboard for charging and lighting

shorts between plates), old plates where the positive plate is concerned, sulphated plates and actual acid leaks between cells due to a fracture of the cell walls. Voltages should be taken after the battery has stood for at least an hour after

charging. Acid for batteries, ready made, is easily purchased at most garages. If battery acid had to be made up, only pure brimstone sulphuric acid should be used, and the necessary water must be distilled. In mixing the acid and water, the acid should be slowly added to the water, never the water to the acid. An appreciable amount of heat will be generated during the mixing, and a suitable non-metallic vessel should be used; the gravity strength should be taken when the mixture is cold, adjustments can then be made by the addition of either water or acid as the case may be.

Cell Vents

Where enclosed types of cells are used, the vents should be removed before charging commences; at the end of the charge, the vents should be replaced, the tops of the cells carefully wiped with a damp cloth, finally drying with a dry one. The terminals should be given a liberal coating of vaseline to prevent future corrosion, acid levels should be checked and it should never be to excess, a covering of ½ in. is ample. Batteries should never be charged or discharged at rates higher than those given by the makers; heavy discharging is likely to cause plate buckling; excessive charging will lead to the production of an excessive amount of positive material, under certain conditions, and arrangements of cells, this active material can bridge across plates causing partial shorts in the cells; this can also happen where cells are left on charge for prolonged periods after the normal charging time is reached. Allowing a battery to stand for long periods in a discharged state is harmful; also, usually sulphating occurs, this sulphate is a hard white deposit on the plates and is very difficult to remove, apart from the actual scraping of the plates. Restoration can be attained in some cases by giving such affected cells a very slow charge for a long period, even then there is no guarantee that this will be successful. Where a battery is used for intermittent service, it should be brought up to full charge about every two weeks, the gravity checked at the end of this charge, and the acid level maintained.

Charging Temperatures

During charging, the temperature of the cells will rise: at no time should this temperature be allowed to exceed about 100 deg. F.; if a high temperature shows, the charge should be reduced or the charge stopped altogether until the cells are normal again. When connecting batteries for charging, the positive pole of the cell should be connected to the positive pole of the charging supply, the negative likewise. Should the polarity be unknown, it can be found by immersing two conductors in some battery acid or common salt and water. The conductor giving off the greatest amount of bubbles will be the negative pole. It must be stressed that when taking this test, due regard must be given to the nature of the charging supply. Should the local supply current be used, or where the voltage is over 50 volts, it will be necessary to arrange for a suitable resistance, such as a lamp to be in circuit while taking this test, otherwise excessive currents are likely to flow.

A description of the two following layouts may be of assistance for any small lighting or power installation. In the first case it is required to have available 24 volts for lighting and power; also, a 12-volt lighting supply and provision to charge one 12-volt battery, with connections for the local lighting circuit. The switchboard arrangement shown in Fig. 2 caters for this. The left-hand panel takes charge of single battery charging. The centre panel is the main panel, or generator panel; on this panel is provision for a supply at 24 volts (generator only). The right-hand panel is the lighting panel: on this, provision is made to charge and discharge the battery as required by means of the change-over switch. The generator used with this layout was an *ex*-R.A.F. Type K machine, 24 volts, 1,000 watts. The terminal markings being O.G. Negative, O.S. & G. Positive.

The arrangement shown in Fig. 3 is more interesting: it calls for a variety of applications that are quite practicable. Two generators are to be used, one at 230 volts and the other at 24 volts. The generators are to be driven by the same engine. Provision has to be made for a 24-volt lighting supply at the house which is remote from the generators. The 230-volt house circuit is for the use of standard electrical equipment used only during the time the engine would run. It is required to be able to charge the house battery from either the 24- or 230-volt generators. A 12-volt starter motor is to be used for starting the engine, and in addition a device for stopping the engine has to be catered for, which must be on remote control from the house; this applies to starting also. The battery supplying the starter has to be charged from the 24-volt generator. Fig. 3 shows the general layout of the switchboard for the installation. The generator is a compound interpole machine, the terminal arrangement is as shown on the drawing. The left-hand panel is the starter battery charging panel. The centre panel is the main or generator panel: on this panel is the main generator switch and fuses, also the main switch for the house supply. On this panel also are the push buttons for starting and stopping the set. The right-hand panel carries the controls for the house lighting at 24 volts, together with battery charging circuit. The leads marked 1. 2. and C. are the extension leads to the remote control position.

Cables

Where low voltage installations are concerned, it is important that the cabling supplying the various circuits are of ample size. If the wiring is too small, unavoidable volt drop is introduced between the source of supply and the apparatus being used. Where lighting is being carried out, the cable size should not be less than 3.20 gauge. Where a starting circuit has to be provided, 7.036 gauge may not be too large. In dealing with starter motors, it should be borne in mind that, depending upon the effort required to move the engine at a speed to start it, a fair amount of power must be available. Horse power values up to as much as 2 may be necessary with a heavy engine; as the starting motor is being fed at a low voltage, the current value will be high per h.p.; it could be as high as 100 amps. or more in

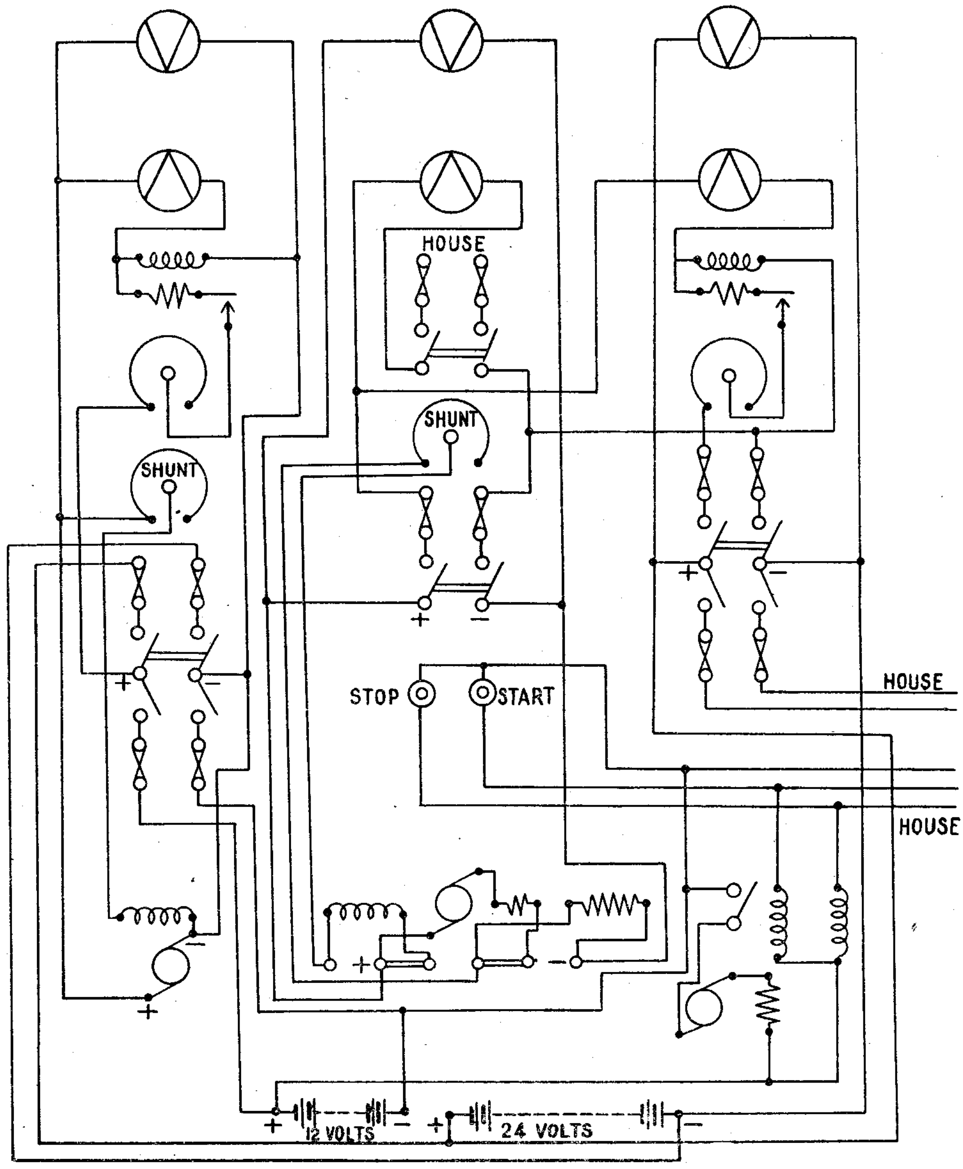


Fig. 3. Layout of a switchboard for a special application

exceptional cases. Therefore, it is important to see that the cabling is of ample size for the duty. Any great drop in the starting circuit would mean a considerable loss of power at the motor.

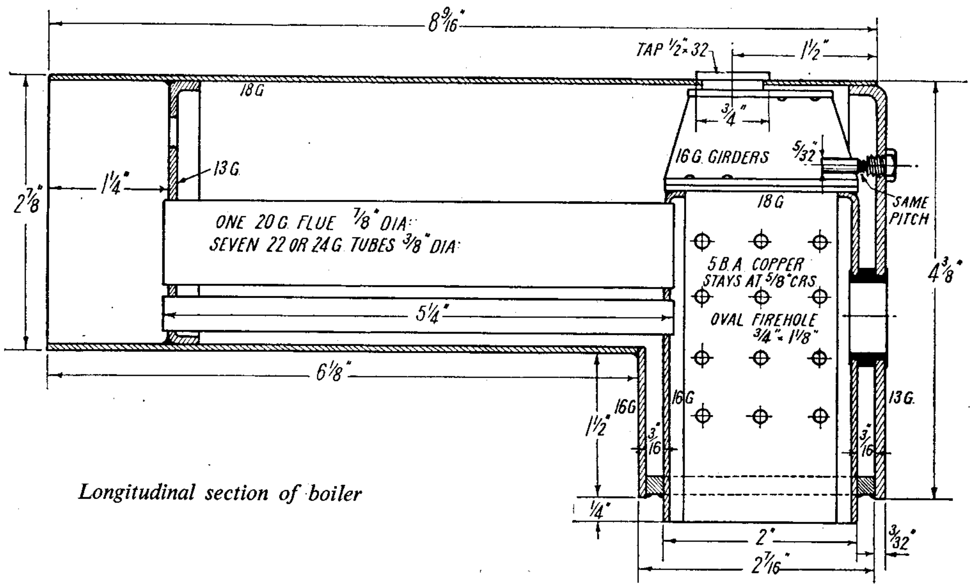
In conclusion, I would stress, that where an electricity supply is at a high voltage, whether a private supply or otherwise, leads should never be held by hand while tests are being taken ; in this case it is meant to refer to any polarity testing necessary. Bearing this in mind, any tests that have to be carried out, should be done by providing a jam jar with two strips of lead immersed in the electrolyte, this, of course, being done before the current is switched on. If lead strips are used, and the testing current left on for a short while, one of the strips will attain a brown surface ; this will be the positive pole of the supply being tested.

The "Canterbury Lamb"

in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

NEITHER of the boilers fitted to the full-sized *Invicta* were anything worth writing home about; in fact, the second one was an absolute and complete washout. They say that "third time is lucky"—'nuff sed! Anyway, the boiler I have schemed out for our small edition is a cross between the larger and smaller boilers specified for *Tich*. Both of those are excellent steamers, so there is no reason to anticipate any shortage of steam on the ancient and honourable old lady. As a matter of fact, she has twice the grate area and a much larger percentage of heating surface than one of my $2\frac{1}{2}$-in. gauge jobs with practically the same cylinder capacity; and this engine's boiler supplies every demand made on it, without the least hesitation. The boiler for *Invicta* is very easy to make; as easy as the smaller *Tich* boiler, as the firebox casing is the same width as the barrel, and the firebox itself has straight side sheets. The *Tich* instructions can be followed in detail, so there is no need to indulge in a very lengthy dissertation on how to build the one illustrated.



Longitudinal section of boiler

Boiler Shell

The barrel and wrapper can be made in one piece, from 18-gauge sheet copper. This is plenty stout enough for this size of boiler. I built *Grosvenor's* boiler from 18-gauge copper, except for backhead and smokebox tubeplate, as I had a good supply on hand. It stood the water pressure test O.K. and has given every satisfaction in service. However, if you have some 16-gauge in stock, use it. Mark out the sheet to the dimensions given in the illustration, and cut to outline; 18-gauge sheet copper can easily be cut with hand snips, by anyone who has a wrist and grip of normal strength. Be careful not to overdo it when making the $2\frac{7}{8}$ in. cuts which form the front edges of the firebox wrapper.

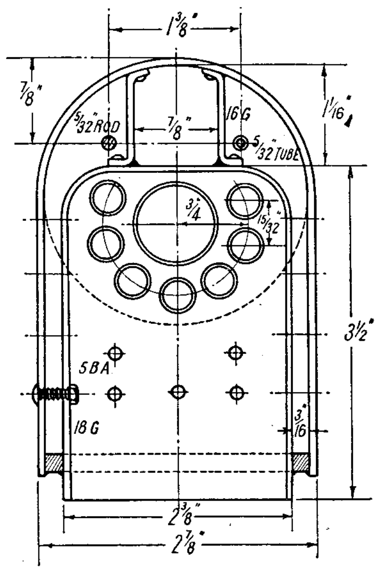
Bending Operations

First bend the copper to an arch shape, then continue bending the $6\frac{1}{8}$ in. portion until it forms a circle $2\frac{7}{8}$ in. diameter; there will be an overlap of approximately $\frac{1}{4}$ in. and a few $\frac{1}{16}$ in. copper rivets can be put in this, at about $\frac{1}{2}$ in. centres, to hold the edges in contact while the brazing operation is in progress. No former plate is needed to make the throatplate. Cut a piece of 16-gauge copper 3 in. $\times$ $3\frac{1}{4}$ in., and bend $\frac{1}{4}$ in. of each 3 in. side at right angles, which can be done in the bench vice. The piece should fit nicely between the front edges of the firebox wrapper. Cut out a semicircle, as shown by the dotted lines in the cross-section illustrated; then rivet the throatplate in place by aid of a few $\frac{1}{16}$-in. copper rivets through wrapper edge and throatplate flanges, the semicircular opening butting up tightly against the edge of the barrel,

as shown in the longitudinal section. The joints can then be brazed, as specified for *Tich*; a $2\frac{1}{2}$-pint lamp, or equivalent size of air-gas blowpipe, will do the needful in this small size, though naturally a bigger one makes far easier work of it. Either easy-running brazing strip, or Johnson-Matthey's B6 alloy, can be used; or if an oxy-acetylene or oxy-coal-gas blowpipe is at your service, use my faithful old pal Sifbronze. I guess I'm just about as ardent a Sifbronzer as George in the S.I.F. journal *Siftips*! In fact, if George did the washing-up, and broke a plate or saucer in the kitchen sink, I shouldn't be in the least surprised to read that he tried to mend it with his blowpipe and a bit of Sifbronze. Whatever you use, don't forget to leave a nice fillet all around the joint between throatplate and barrel, as shown by a little black triangle in the illustration.

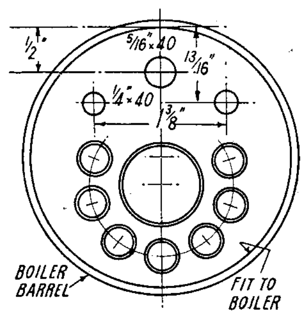
Firebox and Crown Stays

A former will be needed for the firebox tube and door plates, as they are rounded at the top corners; but making it is only the work of a few minutes. Saw out a piece of $\frac{1}{4}$-in. iron or



Cross section through firebox

steel plate $3\frac{3}{8}$ in. long and $2\frac{1}{8}$ in. wide; round off the corners at one end, and file off the sharp edge all around one side, except at bottom. Set out the location of the tube holes on it, and drill a No. 40 hole at each point. The centre of the hole for the $\frac{7}{8}$-in. flue is marked off on the centre-line of the former, at $\frac{1}{2}$ in. from the top; the middle tube is $\frac{3}{4}$ in. below it, and the others are spaced around the flue, at 15/32 in. centres, as shown in the cross-section. Cut out two pieces of 16-gauge sheet copper, same shape as former, but $\frac{1}{4}$ in. bigger all around, except at bottom. Flange these over the former, as fully described in the *Tich* notes; then run the No. 40 drill through the holes, carrying on right through the copper. Remove from former, file off any raggedness around the flange, and clean it with the file. Open out the flue hole with 55/64-in. drill, and ream $\frac{7}{8}$ in., but only put the reamer in a wee bit, so that a $\frac{7}{8}$-in. tube is a tight fit. If you haven't a big drill and reamer, use the largest drill available, and file to size, using the tube end as a gauge. The holes for the smaller tubes are drilled 23/64 in. and reamed $\frac{3}{8}$ in., bare size as above.



Smokebox tubeplate

The door plate is made exactly as above, except that no tube holes are drilled in it. Instead, it carries the firehole ring. To make this, a piece of copper tube $1\frac{1}{4}$ in. diameter, $\frac{1}{8}$ in. thick, and $\frac{1}{2}$ in. long, will be needed. Chuck in three-jaw and turn a step on one end, $\frac{1}{16}$ in. deep and $\frac{3}{16}$ in. long. Reverse in chuck, and turn another $\frac{1}{16}$ in. step $\frac{1}{8}$ in. long, leaving $\frac{3}{16}$ in. full diameter between. Anneal this and squeeze it to an oval shape. Lay it on the doorplate with its centre $1\frac{3}{16}$ in. from the top, scratch a line all around, cut out the piece, poke the $\frac{1}{8}$ in. lip of the firehole ring through the hole, from the side opposite the flange, and beat down the projecting lip of the ring outwards against the plate, until same is gripped tightly against the shoulder. This is shown in the longitudinal section of the boiler.

For the sides and crown of the box, cut a piece of 18-gauge sheet copper 9 in. long and 2 in. wide; bend to the arch shape shown, and rivet the tubeplate into one end, and the doorplate into the other, with $\frac{1}{16}$-in. rivets at about $\frac{1}{2}$ in. centres.

The crown stays are two Z-girders made from 16-gauge copper sheet, 2 in. wide at bottom, $1\frac{1}{2}$ in. wide at top, and 1 in. deep, with top and bottom flanges $\frac{1}{4}$ in. wide. Rivet the bottom flanges to the crown of the firebox with $\frac{1}{16}$-in. rivets at $\frac{3}{8}$ in. centres, spacing the girders $\frac{7}{8}$ in. apart, as shown.

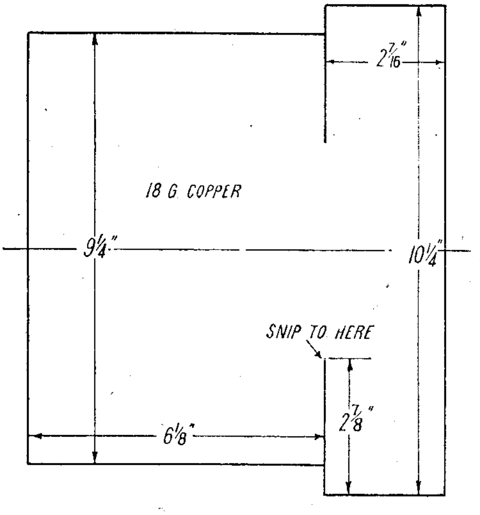
Brazing Up

The asembly can then be brazed up, using the same " technique " as described for *Tich*. Either easy-running brazing strip, or the B6 alloy mentioned above, can be used for the job. If the former material is used, run a little silver-solder along the crownstay flanges before applying the brazing

strip, and see that it sweats right through, covering the rivets. Then run in enough of the brazing strip, to form a good fillet on the side opposite the flange, as shown by the black triangles. When I first described this method of staying the firebox crowns, it was laughed to scorn, like many of my other ideas, by the "orthodox" folk who insisted that rod stays were the only kind suitable. Well, I know of plenty of cases where rod stays have fractured and let the crown sheet collapse, but have never heard of the girders failing, when properly made and erected. Time proves all things! Run a fillet all around the firehole ring as well.

Smokebox Tubeplate and Tubes

There is no separate smokebox barrel on this boiler, the smokebox tubeplate being set in $1\frac{1}{4}$ in. to provide a space for the superheater headers and



Boiler shell in the flat

steampipe connections. The "biscuit-tin" on the full-sized engine merely covered the ends of the three tubes leading from the circular firebox on the second boiler. We shall use it as a base for the chimney; I am suggesting to our approved advertisers, that they cast the circular push-in front with the box integral with it, which will save extra work, and ensure the whole bag of tricks being airtight.

The smokebox tubeplate is made from a circle of 13-gauge copper about $3\frac{1}{2}$ in. diameter, flanged up over a circular forming plate a bare $2\frac{5}{8}$ in. diameter. This will leave the flanged plate large enough to admit turning the flange to fit the barrel of the boiler, as described for *Tich*. Use the firebox former as a jig to drill the tube locating holes; then open out as described for the firebox tubeplate, but this time, put the reamer right through, or file until the tubes enter fairly easily. Countersink the holes a little on both sides of the plate. Drill and tap the three other holes as shown.

There is one $\frac{7}{8}$-in. $\times$ 20-gauge flue, and seven $\frac{3}{8}$-in. $\times$ 22- or 24-gauge tubes, all $5\frac{1}{4}$ in. long after the ends have been squared off in the lathe. It doesn't matter if the flue is a shade under the $\frac{7}{8}$ in.; a plumber friend gave me some offcuts of copper tube $\frac{3}{4}$ in. bore and 20-gauge, as used for all-welded plumbing installations. These are about 27/32 in. external diameter; the metal is of super quality (it *has* to be, for welded plumbing) and they are the cat's whiskers for superheater flues. I used them on *Jeanie Deans* and *Grosvenor*. Fit all the tubes into the firebox, and make sure both tube ends and firebox tubeplate are clean; put the smokebox tubeplate on the outer ends, to support and space them, fair up the whole nest with the sides and top of the firebox, and silver-solder the lot at one heating *a la* the *Tich* instructions. There is no difficulty even for the rawest tyro in doing this, as all the tubes can be got at, to apply the silver-solder. Don't forget to put plenty of flux around each tube, and get the end of the firebox good and hot before you let the blowlamp flame play on the tubes. Use either Easyflo, or best grade silver-solder for this job. Workers who have had a little experience, can use the 24-gauge tubes with advantage, it gives the boiler a little greater efficiency. First-timers should use the 22-gauge tubes, as there is less risk of burning them. Don't forget to pull off the smokebox tubeplate and make the other end of the tubes red-hot, before putting the assembly in the pickle bath.

Fitting Firebox and Tubes into Shell

It is a snip job putting this little boiler together. Fit a bit of $\frac{3}{16}$ in. square soft copper rod between the flanges of the throatplate, then slide the firebox and tube assembly into the shell, fix temporarily with toolmakers' cramps, and rivet through throatplate, rod, and firebox tubeplate with $\frac{1}{16}$-in. rivets at about $\frac{1}{2}$ in. centres. Before riveting, see that the upper flanges of the crownstays are bearing hard on the boiler shell; also, don't forget to have every contact surface clean. Rivet the crownstay flanges to the shell, with four rivets in each. Don't bother about fancy heads outside; they are only filed off afterwards. Put the smokebox tubeplate, flange first, into the barrel, drive it down until it touches the tubes, line them up with the holes by aid of a wooden skewer, or a pencil, or something similar, then drive the tubeplate home until the tubes come through about 1/32 in. or so. The ends can then be expanded by driving a greased taper drift into each, as described for *Tich* and other boilers.

Silver-soldering

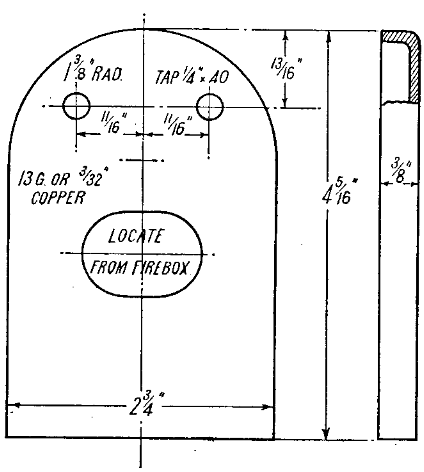
The smokebox tubeplate being well down the barrel, it would be easier to use silver-solder for fixing the whole doings; so flux the ends of the tubes and the circumferential joint, stand the boiler, barrel upwards, in your brazing pan, and heat the lot with the blowlamp. If a $2\frac{1}{2}$-pint or larger is used, there is no need to bother about the holed tray stunt which I usually specify for this job, as the comparatively thin copper will easily heat up sufficiently to make the silver-solder flow freely. If you blow on the tubeplate first, then play on the outside of the barrel at the level of the tubeplate flange, and apply the silver-

solder (best grade or Easyflo) inside, when the copper glows red and the flux has fused, it will run all right. Work your way steadily around, and feed in enough silver-solder to form a fillet. When O.K. play direct on the tube ends, and give them a dose of the same medicine.

Don't lose any time laying the boiler on its back in the pan, with the end overhanging, to do the crownstay flanges, or it will cool off. The flanges should already have been fluxed before starting on the smokebox end ; so all you have to do, is to play the flame, first on the flanges, and then outside the shell, until the metal glows red, and apply the silver-solder, letting it sweat clean through the full width of the flanges, and forming a fillet along the opposite sides. Silver-solder alone can be used, as this little boiler doesn't take much, and the expense isn't great enough to "break the bank." Also the boiler is light enough to allow it to be dumped in the pickle bath by aid of the garden rake or clothes prop ; but mind the splashes, as they fly a long way !

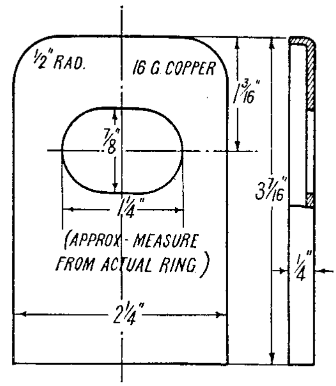
Backhead and Foundation Ring

Cut out an iron former from $\frac{1}{4}$-in. plate in the same way as the firebox former ; make it $\frac{1}{16}$ in. less all around, except bottom, than the dimensions given in the backhead drawing. The copper sheet (3/32 in. or 13-gauge) should be cut a full $\frac{5}{16}$ in. larger than the former. Flange up as usual, filing off any ragged edges and cleaning the flanges. Drill the holes for the stay nipples as shown, and tap them. Measure from top and sides of wrapper, to firehole ring, transfer measurements to backhead, and cut the hole, by the trial-and-error method described for *Tich* and other engines. Then fit the backhead, letting the outer lip of the ring come through the hole, and beat it down on to the backhead, same as the inner one. To prevent any distortion of the plates, rest the inner side of the ring on an iron bar held in the bench vice, or on the horn of an anvil. Secure the wrapper to the backhead flange by aid of a few screwed stubs of 3/32 in. copper wire, as recently described for *Britannia's* boiler. Make sure the surfaces are in very close contact, which makes a better joint when silver-solder is used.



Backhead

Fill in the spaces between bottom of backhead, wrapper, and firebox sheets, with pieces of $\frac{3}{16}$ in. soft square copper rod, taking care to make good joints at the corners. Rivet in place with $\frac{1}{16}$-in. rivets ; and if there are any interstices where the corners abut, fill them up with splinters of copper. The pieces of copper rod forming the ring, should be sunk about $\frac{1}{16}$ in. below the edges of the wrapper and backhead, when the boiler is upside down.



Firebox doorplate

The final braze-up can be done with easy-running brazing strip, the B6 alloy, or entirely with Easyflo or best grade silver-solder. The latter is best when only a $2\frac{1}{2}$-pint lamp is available, but it is naturally the most expensive. A five-pint lamp will make short work of the job, with little coke packing, if B6 is used ; the easy-running strip will need the boiler packing in the coke or breeze, as described for *Tich* and *Britannia.* Whatever you use, after a preliminary heat-up, start at one corner of the foundation ring and work your way right around ; then up-end the boiler, and do the backhead joint, starting from the bottom of one side, and going right around to the other one, running some silver-solder around the firehole ring when you reach it.

Only one bush is needed ; but if it is made pretty big, it can be used for washing out the boiler, if the water used is very impure. It is, in some districts ; when I lived at Norbury, I had to wash out old *Ayesha's* boiler after 20 hours' steaming, and the domestic kettles every week. Where I am now, the kettles never need any washing out, as far as "fur" is concerned, and there is no deposit in the locomotive boilers. Make the bush from $\frac{3}{4}$-in. copper, bronze or gunmetal, and tap it $\frac{1}{2}$ in. $\times$ 32 or the nearest to that for which you have die and tap ; silver-solder it direct into a hole in the wrapper, $1\frac{1}{2}$ in. from backhead. Next stage, staying and fittings.

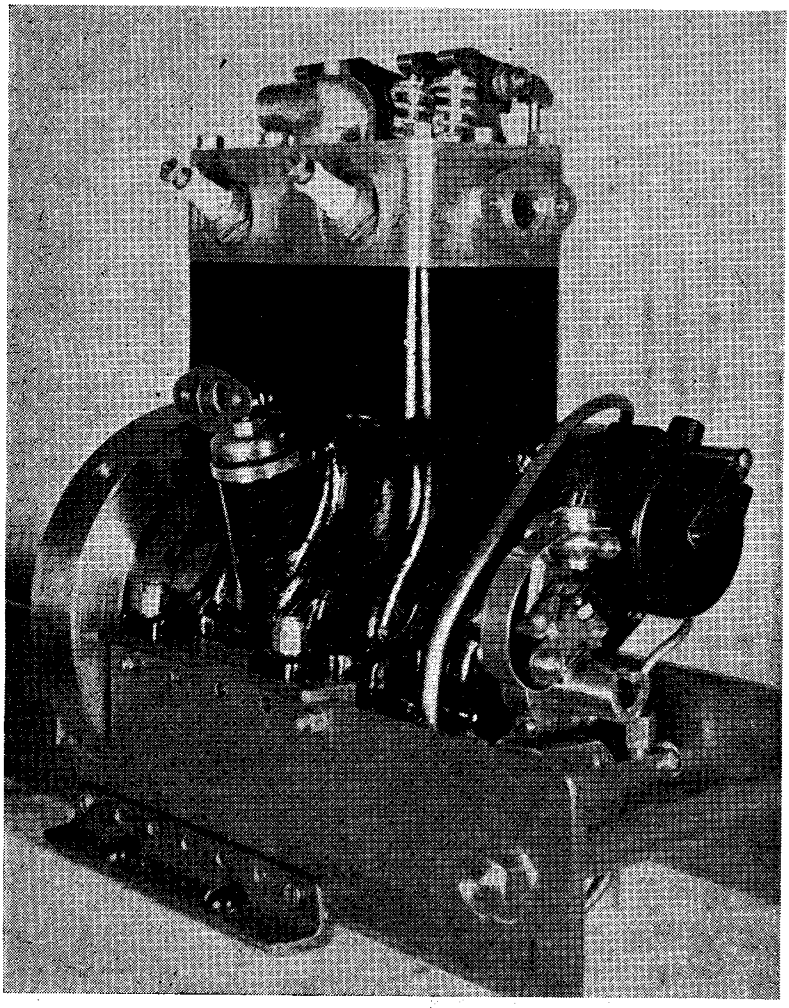
Progress with an "1831"

by A. E. Case

THE photographs show progress to date, towards an "1831" locomotive. The power unit being, in my estimation, the most difficult part, I decided to tackle that first.

There are several departures from the original design, the major one being the oil pump. This is of the vane type with two spring-loaded vanes running in an eccentric housing. Fitting this type of pump meant reversing the inlet and outlet, the pipes crossing beneath the pump. On test with the engine being driven by the lathe at 350 r.p.m., the pump delivered at well over 100 lb. per sq. in. This resulted in a relief-valve being fitted, the loop returning oil to the sump can be seen under the distributor.

The first crankshaft, machined from a bar forged out of a piece of good quality mild-steel crankshaft, about 4 in. diameter (the flywheel is a slice of the same material), was scrapped. For it was found on completing the machining that the centre main bearing journal was running about 10 thou. out of truth. This was caused by distortion, the forged bar not being normalised after forging. A second bar was forged, normalised and machined with complete success.



Showing the oil pressure relief-valve fitted to pump

The camshaft is machined from mild-steel, the cams were machined to thickness, finished for contour on the fixture described by Mr. Westbury and polished, but the diameters of the remainder of the shaft were left 40 thou. oversize. A length of 1 in. gas barrel screwed both ends, about 1 in. longer than the camshaft was obtained with two female caps to fit. One cap was screwed to the barrel and the camshaft inserted, case-hardening compound being packed all around it and the second cap screwed on after first drilling a small hole in it to allow the contents to breathe. The whole lot was then dropped into the sitting-room fire and allowed to glow at bright red heat for a couple of hours, after which it was cooled as slowly as possible. On opening the tube

(the caps had to be sawn off, by the way) the camshaft was found to be completely free from scale and pitting. The plain diameters were turned down between centres to within 10 thou. of finished size (thus removing the carburised metal) and the cam faces repolished. The camshaft was finally heated to a medium red and quenched in water, making the cam faces glass hard, and leaving the remainder of the shaft soft, to be machined to drawing.

Timing gears and pinions were cut with the aid of the Myford dividing attachment, using home-made flycutters, and turned out satisfactory. The remainder of the parts were machined and fitted with very little trouble or snags. Hexagon-headed bolts for securing the main bearing and big-end caps were machined from annealed Allen keys with suitably machined Allen screws for box spanners.

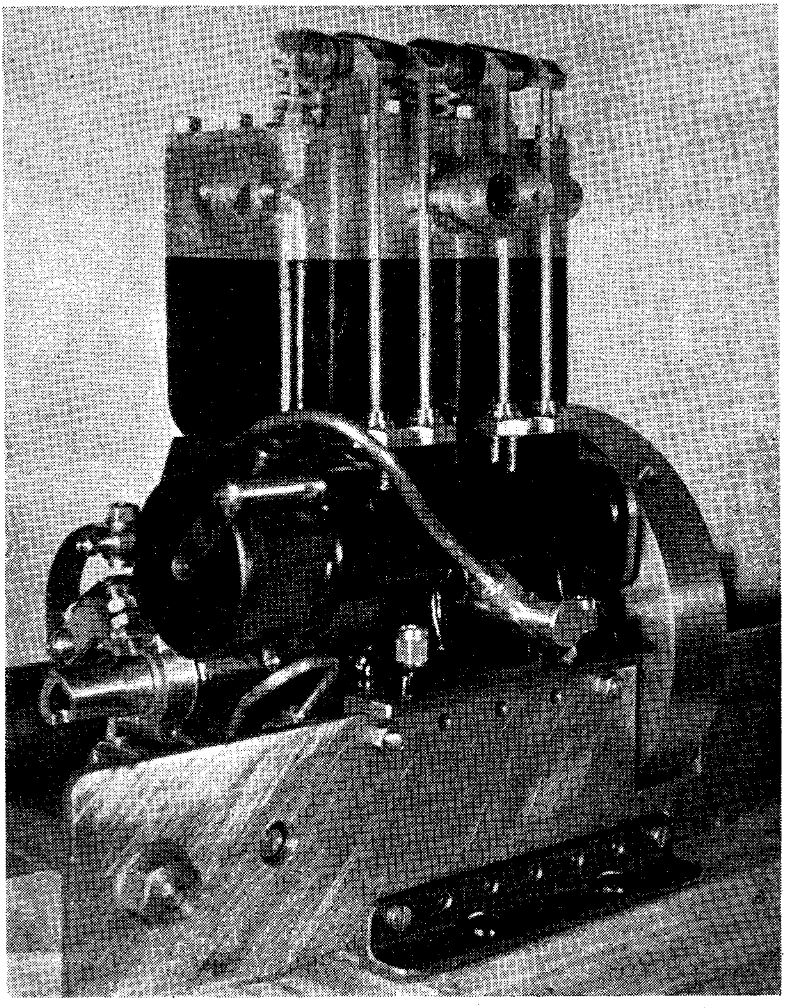
The chassis on which the engine is mounted is for testing only, the hole through the plate beneath the distributor is to clear the adjusting-screw of the relief-valve. The depth of the chassis is such that when the angle-iron feet are clamped to the cross-slide of my M.L.7 the centre height of the crankshaft coincides with that of the lathe. This will be useful for running-in and initially starting the engine.

I am now, time of writing, engaged in making the carburettor, and, when fitted along with exhaust pipes and lower water outlet, the engine will be ready for testing.

I hope to fit a device to the engine, so that an ignition warning light circuit is broken, only when oil is being fed to the main bearings at working pressure. An experimental circuit-breaker can be seen fitted under the oil regulating-valve in the photograph on this page.

Now that the engine is almost complete, I am looking forward to making the locomotive chassis, for which all necessary castings and most of the materials are to hand. To minimise friction as much as possible the main axles are to be mounted in ball-races, and towards this end, six 22 × 8 × 7 mm. double row self-aligning ball-bearings (surplus equipment) have been obtained. On taking one of these races to pieces, I found that the inner race can be softened, bored out to 0.385 in. (this is to clear the wheel seating diameter) and re-hardened. The outside diameter of these races are such that they will fit into the original axleboxes suitably bored out.

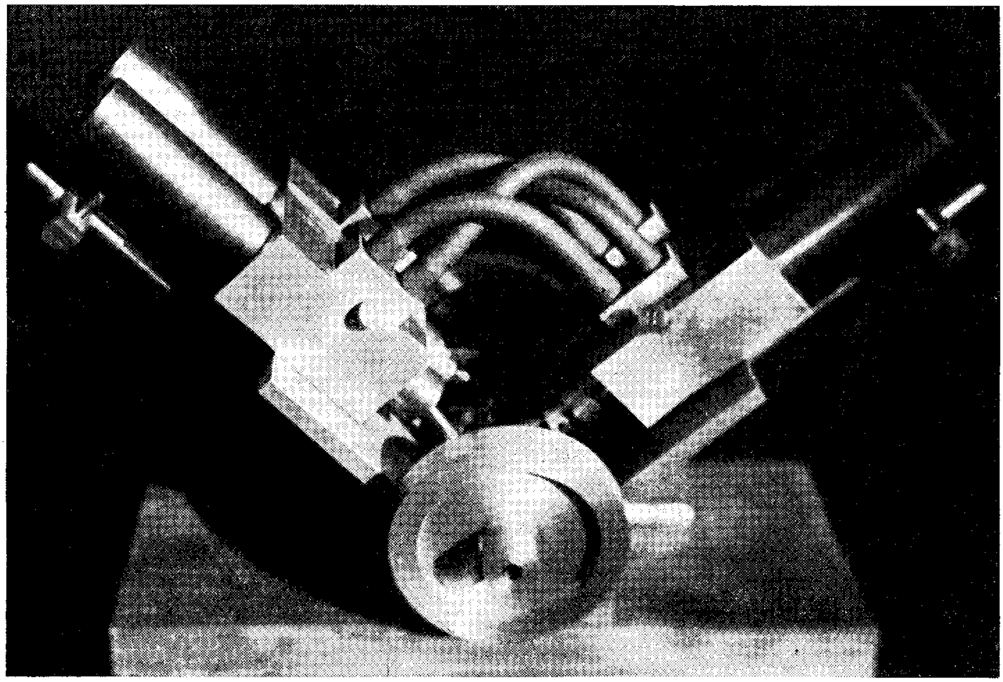
[The articles on the construction of the petrol-driven model of the L.M.S. diesel shunting locomotive "1831," appeared in THE MODEL ENGINEER, from January 2nd 1941 to July 23rd 1942, mainly at fortnightly intervals. Castings for the engine and chassis components are obtainable from Mr. W. H. Haselgrove, 1, Queensway, Petts Wood, Kent.—EDITOR, "M.E."]



The carburettor side of the engine

THE CORVUS "VEE FOUR" HOT-AIR ENGINE

by J. W. Corbett



THE accompanying photograph and drawings show a "Vee Four" engine which I have recently designed and made. Its special features are as follows: There are only two cranks, which serve four power and four regenerator cylinders. The arrangement of the cylinders at 45 deg. allows of this, at the same time giving four separate and equal impulses in each revolution. Lubrication is by splash, from the sump, but four oil holes are provided as primers to the piston-rods, connecting power pistons with displacers. When the engine is running at speed, these are no longer required.

As will be seen, the impulse from regenerator does not influence its adjacent power piston, but the air displaced passes over to one of the opposite power cylinders. Two of the connecting tubes cross over in direct line, and the other two are crossed diagonally. By reversing the order of these, the engine runs in the opposite direction.

The sequence of impulses, four to each revolution, is as follows:—

Power cylinder No. 1 fed by regenerator No. 4
" " " 3 " " " " 1
" " " 2 " " " " 3
" " " 4 " " " " 2

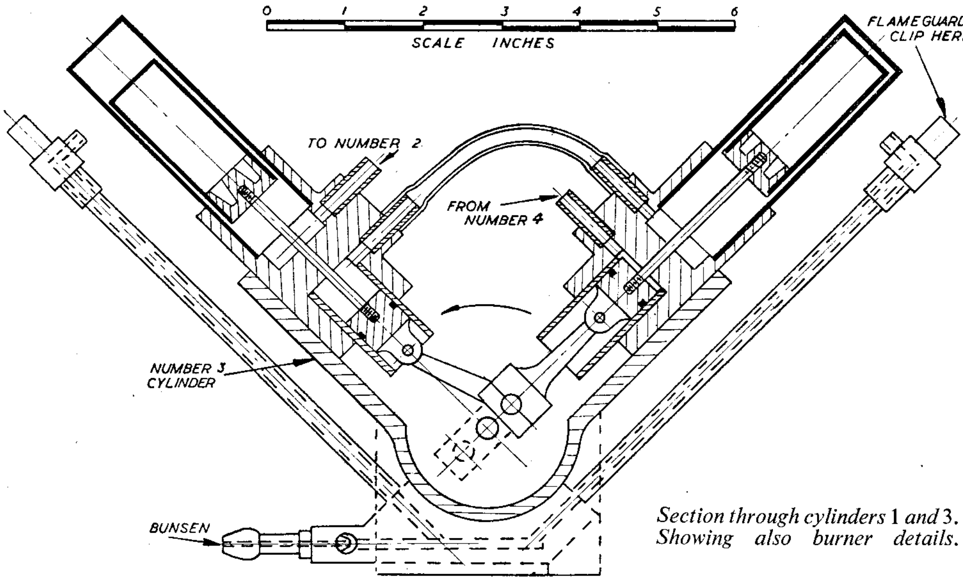
The base, flywheels, cylinder blocks and power pistons are of aluminium alloy. Regenerator and power cylinders are of monel metal and displacers are soft aluminium tubes. The crankshaft is of the built-up type, with silver-steel shaft and crankpins, and the burner fittings are of brass.

Inter-cylinder tubes are of tough rubber, which so far shows no sign of deterioration, although the engine has run many hours at high speed. These could, of course, be of metal, but the rubber allows of easy dismantling if need arises.

Redex (neat) seems to suit as lubricant extremely well.

The engine has two 3 in. flywheels, but runs just as well with one or none at all. It starts instantly, and if stopped by hand when warm, starts again of itself; it runs smoothly at all speeds from 60 to 1,000 r.p.m., the only sound being a pleasant purring hum.

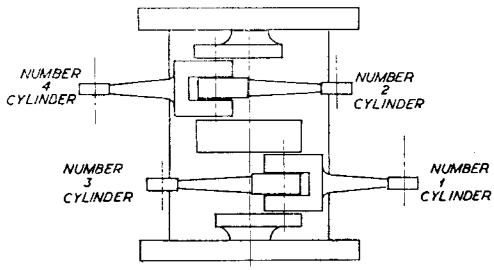
As I wished to obtain a silent engine, I used plain bearings. Less friction and more speed would no doubt result from the use of ball-bearings, adding a little more noise and perhaps causing oil leakage from sump, which would



Section through cylinders 1 *and* 3. *Showing also burner details.*

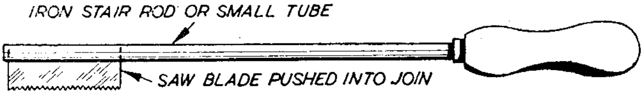
get on to the flywheels and then be flung 4 ft. If using the engine by the fireside, as I often do, the housewife would have something to say.

Since taking the photograph, I have added side-pieces which completely close the crank chamber, leaving only the flywheels to be seen working. Sides are instantly removable, of course, as everybody wants to see the "works." I shall be pleased to answer any questions about this engine, addressed to me care of the Editor, on receipt of a stamped addressed envelope.



Crankshaft layout—180 *deg. laid flat*

A Use for Broken Hacksaw Blades



A USEFUL hacksaw tool for work in inaccessible places may be made from about 18 in. of round conduit, or similar iron tubing, which has an open unwelded seam. An old stair-rod was used by the writer.

Spring open the join slightly at one end and push in a few inches of broken-off hacksaw blade, so that the teeth protrude, and the back of the blade rests again the inside of the tube. The blade will remain firmly in place, due to the spring of the tube. Fit a round handle to the other end of the tool

The result is a saw which can be operated safely on remote jobs in confined places, for cutting off bolts, slotting damaged screw heads, etc., without fear of injuring intervening parts such as wires with the saw teeth —WILLIAM E. THOM.

Making a Workshop Camera

by "Dioptre"

TO complete the general construction of the camera, apart from fitting the bellows, a ground-glass screen is required to replace the dark slide when focussing the camera.

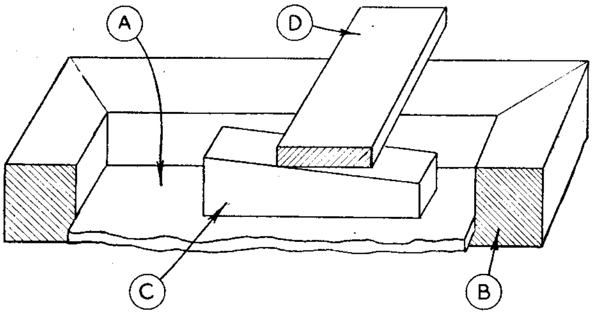


Fig. 53. *Method of checking the position of the ground glass with a rule and taper gauge*

The Focussing Screen

It will be easier to focus the image sharply if the glass screen is of the finely-ground variety, obtainable from photographic stores. But a satisfactory screen can be made by working a sheet of glass with a metal or wooden rubbing block, charged with a mixture of carborundum powder and turpentine or paraffin. The wooden frame carrying the glass can be of quite light construction, and should be furnished with a leather tab to facilitate handling. Channels should be provided between the glass and its frame to serve as vents for allowing the air within the camera to escape as the bellows are closed.

There are two important points to be borne in mind when fitting the focussing screen : first, the area of the exposed glass should correspond exactly to that of the photographic plate when the dark slide is in position and its shutter withdrawn ; otherwise, there will be a danger of cutting off part of the object photographed. Secondly, the ground surface of the glass, which faces inwards, must lie at exactly the same distance from the back face of the camera as the coated surface of the plate in the dark slide. These distances can be easily checked by the method illustrated in Fig. 53, where (*A*) represents the surface of the ground-glass and (*B*) is the wooden frame. A rule (*D*) is placed to bridge the frame, and a metal or wooden wedge (*C*) is advanced to make contact with the edge of the rule.

After the line of contact has been marked with a pencil, the test is repeated on the dark slide with a plate in place and the shutter withdrawn. The position of the ground-glass can now be adjusted until identical measurements are obtained.

Fitting the Bellows

Although in the past we have had no difficulty in making camera bellows of leather cloth, this material seems at present to be unobtainable, and rubberised cloth is used instead.

Leather cloth can readily be jointed and glued to the woodwork of the camera, but the rubber-coated material is more difficult to attach securely. For this reason, wooden frames have been

Continued from page 650, "*M.E.*," *November* 13, 1952.

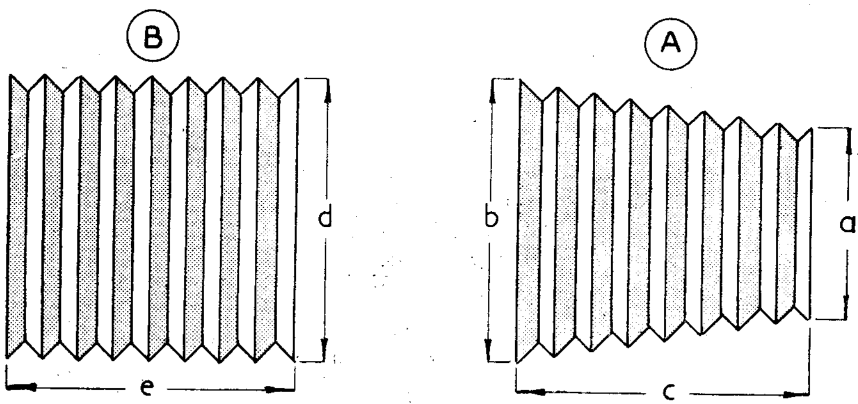
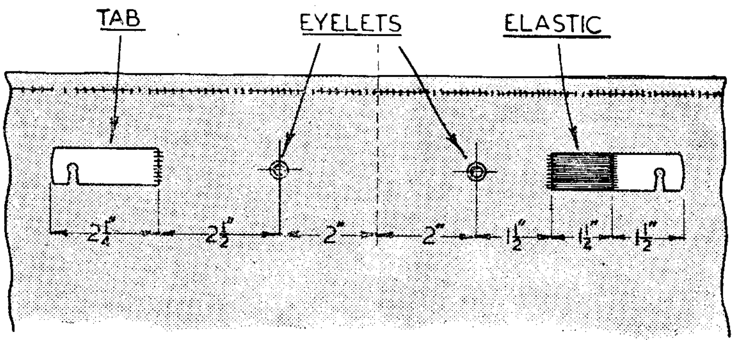


Fig. 54. *The two sections of the square bellows. Diameter* ("*a*") *equals* 3¾ *in.* ; "*b*" *and* "*d*" *equal* 6 *in.* ; *maximum working length* "*c*" *and* "*e*" *is* 11 *in.*

specified for attaching the rear section of the bellows and also the back of the front section. The front end of the front section is secured to the woodwork of the camera front by means of a small, mitred, wooden frame fixed inside the bellows.

There is no difficulty in doing this, as, when the bellows are closed, there is a clear working space within. The four side-pieces of the frame are screwed into position separately, so that they can be fitted within the folds of the bellows to make a satisfactory joint.

When fitting the bellows to the central frame, it is a good plan to fit in this position a diaphragm having a central aperture of about $3\frac{1}{2}$ in. square. The purpose of this is to help in cutting off any light reflected within the camera and stop it from reaching the sensitive plate. The diaphragm can be made of dull, black cloth, or card treated with dead-black paint can be used. After both bellows have been fitted, a test for the light-tightness of the camera should be made in a dark room. After some little time has been allowed for the eyes to become dark-adapted, a hand torch, introduced through the lens panel, is shined everywhere within the camera and every point of possible light leakage is carefully examined. The most likely places for a fault to be found are at the corners of the frames where the bellows have a flat side ; but any light leaks in this situation can easily be stopped by slackening the frame and then placing a strip of black paper across the corner, so that when the frame is again tightened the paper will be securely held.



Left—Fig. 55. Part of the focussing cloth with its attachment tabs and eyelets

The Focussing Cloth

Few things are more annoying than a focussing cloth that parts company with the camera, or falls into folds and obscures the view of the focussing screen. To obviate this, the head cloth is attached to the back of the camera, so that when the head is moved backwards the cloth is kept taut.

The method of attachment is illustrated in Fig. 55. Two tabs are cut out from a sheet of red fibre, or other material, and are shaped at their ends to hook on to the pivot-screws on which the camera back hinges. One tab is sewn directly to the cloth, and the other is attached to a short length of elastic so as to keep the cloth on the stretch when fitted in place. After two eyelets have been fixed in the upper run of the cloth, the tabs are hooked on to the camera and the position of the eyelet holes is marked on the camera frame. When two round-head wood screws have been inserted in these positions, it will be found that the cloth is firmly held, although it can be instantly detached when required.

There is, however, usually no need to remove the cloth, as, when turned forwards, it will serve to cover the camera and protect it from dust.

Stove-enamelled Finish

Since beginning this series of articles, experiments have been going on with stove enamelling and, as a result, the camera base casting, tilting

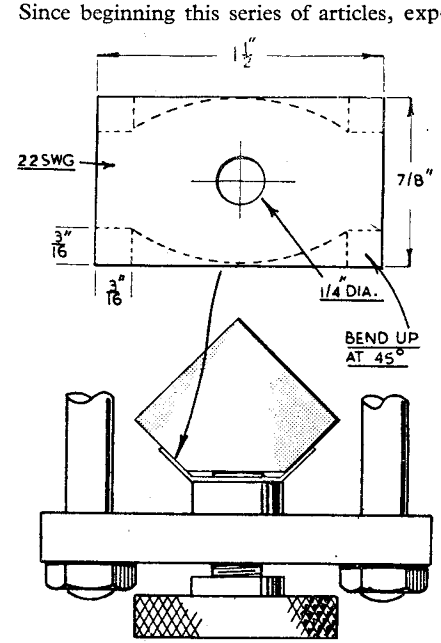


Fig. 56. Method of fitting a pressure spring to the front slide

(*Continued on page* 720)

The Allchin "M.E." Traction Engine

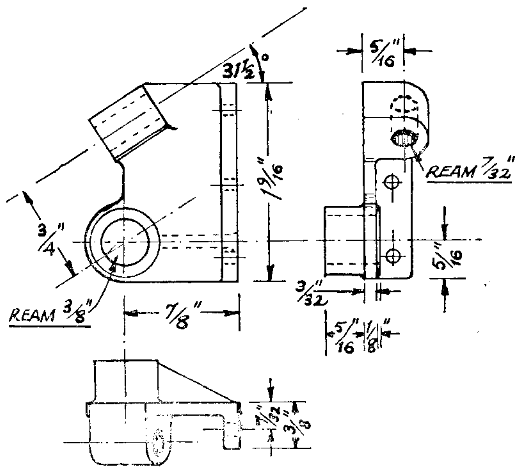
to $1\frac{1}{2}$-in. Scale

by W. J. Hughes

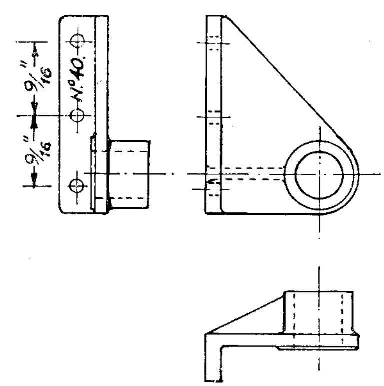
THE two brackets which carry the steerage-shaft, worm-wheel, worm and lower end of the steering-wheel spindle, are bolted to the angle-brackets which we have already riveted to the hornplates. Once the latter are fixed to the firebox sides, it would be difficult to drill the bolting holes in the angles, so we had better make and fit the shaft brackets next.

square with the face of the wood. Fasten the bracket to the edge of the wood with small wood-screws, and this should bring the boss for the steerage-spindle horizontal, as sketched.

Set your scribing-block exactly to the height of the centre of the large boss, and measure the vertical distance. Increase this by exactly $\frac{3}{4}$-in., and you can mark out the centre-line on



Left-hand bracket for the steerage shaft



Right-hand bracket for steerage shaft

These could be fabricated, but A. J. Reeves is making some neat castings for them. If you are one of the chaps who makes his own patterns and has castings made locally, the latter can be in either iron or gunmetal.

When cleaning up the castings, the only face which can be used as a reference is the back bolting face, and this should be filed flat and straight, with especial care to keep it square with the other web.

First of all set out the centres of the large bosses to the dimensions given in the drawings. (By the bye, if you are working from the blueprints, these two brackets are not on any of the existing sheets, but will appear on a later one. Just thought I'd mention it, to save you hunting through the prints !) You can also set out and drill the three No. 40 holes in each bolting face.

Now (taking the left-hand bracket first) mark a line at $58\frac{1}{2}$ deg. across a piece of wood—a bit of old $\frac{1}{4}$ in. thick plank would do—and saw the wood off at this angle, keeping the saw-cut

Continued from page 579, " *M.E.*," *October* 30, 1952.

the steerage-spindle boss. With odd-legs or dividers set to $\frac{5}{16}$ in., mark the lines at right-angles to the first centre-line, on the ends of the boss, and your centres should be right.

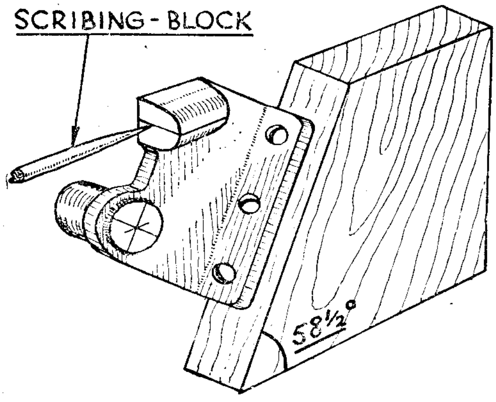
While the bracket is screwed to the wood, the latter may be gripped tightly in the machine-vice, with the steerage-spindle centre-line vertical, and the hole may be drilled reaming-size for 7/32 in. If you have not this size of reamer, use the 13/64-in. drill, and follow through with the 7/32 in. size.

After removing the bracket from the wood, the hole in the large boss may be drilled and reamed to size, but care must be taken to get it properly square, and parallel with the bolting-face. Following this, the same operation is performed on the right-hand bracket.

All that remains is to clamp these two brackets to the angles fixed to the hornplates, and through the No. 40 holes to jig-drill those in the angles. Before tightening the clamps, slip a piece of $\frac{3}{8}$-in. rod through the holes in the two large bosses, and check to see that it is parallel with the two bottom corners of the hornplates.

The uppermost hole in the left-hand bracket cannot be jig-drilled in this way, however,

because the spindle-boss is in the way; it can be marked through with a bent scriber, and centre-popped and drilled when the bracket has been removed after drilling the other two. After drilling the holes, remove the burr caused



Sketch to show method of holding bracket

by the operation, and the brackets may then be bolted temporarily in place with 7-B.A. hex-headed screws and nuts.

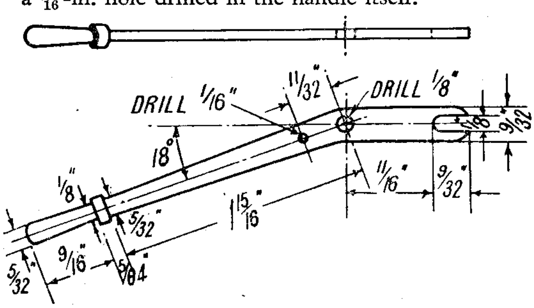
Gear-change Lever

For the gear-change lever you will require a piece of bright mild-steel $3\frac{1}{8}$ in. by $\frac{1}{2}$ in. by 16-gauge, and its handle is turned from a stub of $\frac{1}{4}$-in. rod.

Set out the handle to shape, and very lightly centre-pop the lines, as we did with the horn-plates, to assist in the filing up. To form the fork at the end, drill a $\frac{1}{8}$ in. diameter hole at a distance of 7/32 in. from the end, and then saw the waste out with a "Junior" hacksaw, finishing with a fine file.

Set out and drill the $\frac{1}{8}$-in. and $\frac{1}{16}$-in. holes in the lever, and then the latter may be filed to shape.

At the handle end of the lever, file a spigot $\frac{1}{8}$ in. long by $\frac{1}{16}$ in. diameter, which is to fit into a $\frac{1}{16}$-in. hole drilled in the handle itself.



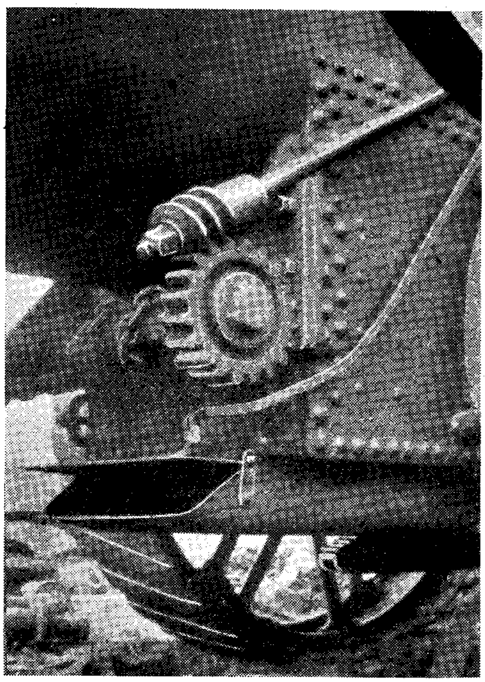
Lever for gear-change

For the handle, grip a 2 in. or 3 in. length of $\frac{1}{4}$-in. steel rod in the three-jaw chuck, and turn it to the shape indicated, with the collar outwards. Make the latter about $\frac{3}{8}$ in. long, however, instead of the 5/64 in. given in the drawing—the reason for this will be apparent in a few moments.

Centre the end, and drill down to a depth of just over $\frac{7}{16}$ in. with a $\frac{1}{16}$-in. drill. Part off at a distance of $\frac{9}{16}$ in. from the inner end of the collar.

Now you can use the surplus on the collar to grip the handle the other way round in the chuck whilst the outer end is slightly rounded. When this is done, the handle may be finally parted off from the surplus.

The handle may now be driven on to the spigot filed on the lever, and the joint silver-soldered with Easyflo. The whole thing may be cleaned up and polished, but not *too* highly polished,



Photograph No. 17.—The steerage worm and worm-wheel, and left-hand shaft bracket of the Allchin traction-engine

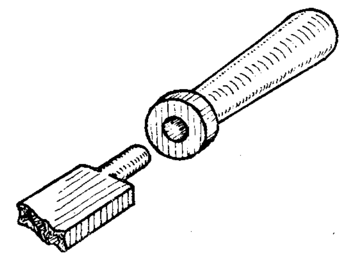
please. This is a traction-engine, and not an entry for a motor car *concours d' elegance*!

By the bye, on the blue-print, the advice is given to case-harden the fork and pivot, but on more mature consideration, I do not think this is really necessary, if the pins are hardened. With a spot of oil on them from time-to-time, the wear will be very little.

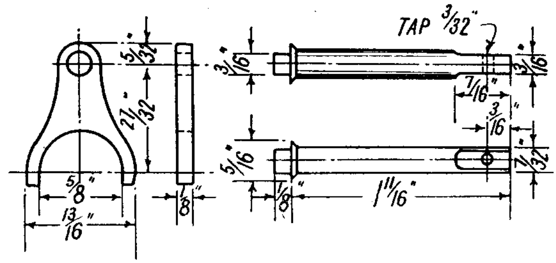
Gear-change Fork and Shaft

A scrap of 10-gauge bright mild-steel $1\frac{1}{8}$ in. by $\frac{7}{8}$ in. will make the gear-change fork, and the setting-out and filing to shape are both simple matters.

The shaft is turned from a short end of $\frac{5}{16}$ in. diameter steel. After facing the end, let the rod project from the chuck about $1\frac{7}{8}$ in., and turn



Method of fixing handle of lever



Gear change fork and shaft

down to 7/32 in. diameter for a length of $1\frac{5}{8}$ in. full. Take light cuts because of the slenderness of the rod, and use plenty of cutting-oil.

Turn the sloping part of the collar, and part off at $1\frac{13}{16}$ in. full. Reverse in the chuck, face the end, and turn down to $\frac{3}{16}$ in. diameter for a length of $\frac{1}{8}$ in. This spigot should be a tight fit in the $\frac{3}{16}$-in. hole in the fork, of course.

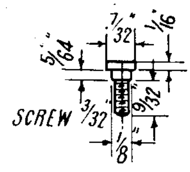
File the two small flats on the other end and drill and tap the hole for the pivot-pin, which may be either 3/32 in. or 7 B.A. Finally, fit the shaft and fork together, making sure that the flats are correctly positioned in relation to the fork, and silver-solder the joint. Clean up and polish.

Pivot Pins

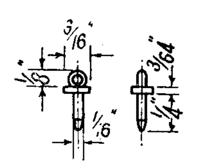
There are two pivot-pins in the gear-change; one on which the lever swings, and one screwed into the shaft, with which the fork of the lever engages. Both are identical, and are simple turning-jobs which need no detailed instructions.

The screw-threads should be either 7 B.A. or 3/32 in., of course, to match whichever thread you have used in the gear-change bracket and the shaft. Tip: do not make the threads too tight, or you will have difficulty in screwing the pins home, since there are neither spanner-flats nor screw-driver slots on the heads.

If the pins are made of mild-steel, the shoulders may be case-hardened; alternatively the pins may be of silver-steel, hardened and tempered to straw-colour. In either case, before heating the pins for the hardening process, make a small steel sleeve which can be screwed on to the threaded part of the pin to protect the thread from the oxidisation.



Gear change pivot pins



Gear change lever locking pin

Locking Pin

To hold the gear-change lever in any of its three positions—fast speed, neutral, or slow speed—a locking pin is used. Again this is a bit of delicate turning work, with the addition of a spot of filing—also pretty delicate—to form the eye. However, the drawing gives all relevant detail, so again it is not considered necessary to give precise instructions for making the pin.

(*To be continued*)

Making a Workshop Camera

(*Continued from page* 717)

table, and the V-blocks have been given a wrinkle or crackle finish. This finish is usually regarded as the best for many kinds of instrument work, and it certainly enhances the appearance of the camera.

A Small Improvement

Although the camera has been in use for a year and has taken some scores of photographs, its working has proved in every way satisfactory, and only one small addition has been made. When the camera front was moved along the bed during focussing, it was found that the front V-block had a tendency to tilt under the pull of the bellows, and this interfered somewhat with the smooth working of the slide.

To correct this, a spring pressure-plate was fitted to hold the V-block down to the bed, and the outcome was entirely satisfactory.

As will be seen in Fig. 56, a strip of spring brass is drilled centrally for the passage of the front slide clamping-screw and, after the material has been filed to shape, the four corners are hammered down to bear closely on the sides of the bar bed.

Finally, the spring is given a set at its centre so that, when in place, its ends press firmly against the under side of the bed.

Mr. Haselgrove will, we hope, be able to supply the necessary castings and materials for the construction and, perhaps, Mr. Wain, who advertises in this journal, will consider making the bellows for readers interested in building the workshop camera.

PRACTICAL LETTERS

Hand Scraping

DEAR SIR,—I do not intend to enter any controversy, but I must answer Mr. Upton.

I claim no specialist experience but repeat I have known a number of machine tool fitters, none of whom used the "Sparey type" scraper; moreover, happening to be in London when your issue of August 28th reached me, on my usual call on the (probably) largest supplier of small tools in this country, I questioned the senior counter-hand and he, with a lifetime of experience on the supply side, said that the firm did not and never had supplied scrapers of the type in question. This is not conclusive, but does lend some support to my contention.

As regards the surface plates, I did not see the work in progress but reported what my good friend, the late Frank Moore, told me when I was visiting his works. There was no suggestion that the job was done without supervision—it is sufficiently remarkable as stated.

It may be, and probably is, safe to assume truth in machines intended to work to 0.0001 in. limits. I was concerned with machines commonly found in "the home workshop," where the last 0.001 in. is frequently illusive! Machines built with one eye constantly fixed on cost of production. I repeat, that experience has taught me the unwisdom of "taking for granted" anything susceptible to simple tests—on that I stand pat, entirely unrepentant. Mr. Upton's reference "hours on elaborate tests" is not to the point, as I specifically stated "simple, easily applied tests." I have found this procedure a great saving in time and labour.

My letter dealt, quite obviously, with scraping to produce flat surfaces and for correcting inaccurate alignments and the like, and not at all with "frosting" lapped surfaces for lubrication or ornamental finishes; as the objects in view are utterly different, it is to be expected that procedure would be likewise.

While accepting Mr. Upton's statements as to the practice in the "shop" where he works, I still think that for the purposes I have indicated the common and usual methods are the most serviceable,

Yours faithfully
K. A. HELLON.

The Traction Engines at Hull Docks

DEAR SIR,—Further to the information forwarded by Mr. K. Birkby, published in the September 25th issue, it seems this gentleman arrived on the dock in time to see these engines being cut up for scrap. To the best of my knowledge they were, however, originally destined for export to Belgium, to be put to use there. I myself had the good fortune to be present and concerned with the testing under compressed air of three of these engines, which after standing idle for years, ticked over quite smoothly once the motors had been freed off and well oiled. I hope that mention of these tests will set Mr. Birkby's mind at rest as to why some of the washout plugs, etc., had wooden bungs driven in.

The unusual Fowler he mentions also had a sister on the occasion of my visit, these I took to be a pair of ploughing engines, one of these engines had on a plate reading "2979B, Steam Users' Association, Manchester."

The Ruston-Hornsby engine which Mr. Birkby mentions was No. 166246 and really was the best cared-for engine there.

Yours faithfully,
Beverley. A. B. DUNN.

Auxiliary Lathe Headstock

DEAR SIR,—I must compliment R. L. Kibbey on his high speed headstock (October 2nd issue) and it may be of interest to note that my works (owned by my father) have employed a headstock of this type

This was manufactured in 1941, as we had to machine ebonite mouldings with diamond tools and needed a speed of 1,600 r.p.m.

It was made in very much the same way as Mr. Kilbey's. After shaping of the base to suit the bed of a 6 in. Colchester lathe, it was attached to the saddle and bored to fit two roller-races with a between-centre bar.

The spindle is a replica of the lathe's, and bored ¾ in. through, with No. 3 Morse socket, running in the two roller-races and two thrust races, and is driven by a 2 h.p. motor mounted above the lathe, the drive being a 2 in. belt on fast and loose pulleys.

In view of this, and knowing how useful and effective it is, I can recommend any model engineer to build one. To give but one job, a dozen pens for cylinder recording were produced in nickel and using an 80 drill (in a 6-in. lathe).

Many fine feeds are obtained by running the lathe at slow speeds, and using the sliding and surfacing feeds.

May I suggest that Mr. Kibbey screws, internally, the tail end of his spindle. This would enable a length stop to be used.

Yours faithfully,
Sheffield. W. ARNOLD MILNES.

Drilling Machines

DEAR SIR,—May I draw your attention to an error which was made in "Smoke Rings," with reference to our exhibit of ten drilling machines at the recent "M.E." Exhibition.

The castings were a commercial product and *not* a result of club activity. In fairness to the trade, I think this point should be mentioned.

I stated on our entry form whose castings they were and I think this should prevent any ill-feeling on the part of the supplier.

In the case of the lathe project we have in hand, the drawings were done by members, also some of the patterns; other patterns were made by a friend, also interested in model engineering, who is a member of the Radio Controlled Models Society (Birmingham Group).

Yours faithfully,
Redditch & District M.E.S. WM. A. ALDERTON.